ENERGY MANAGEMENT SYSTEM (EMS) STUDY

FORT BELVOIR, VIRGINIA

Department of the Army
Baltimore District, Corps of Engineers

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FINAL SUBMITTAL
VOLUME 2 OF 2

Energy Management System (EMS) STUDY

Fort Belvoir, Virginia

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BUILDING 247

SIMULATION WEATHER DATA SUMMARY

Data: Washington, Dist. of Columbia (TMY) 12-30-94

HAP v3.04

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TABLE 1. SIMULATION WEATHER DATA DESIGN PARAMETERS

City	Washington
Location	Dist. of Columbia
Type of Data	Typical Meteorological Year
Latitude	38.9 deg
Longitude	77.0 deg
Elevation	14.0 ft
* Average Ground Reflectivity	0.20
Local Time Zone (GMT +/- N hours)	5.0 hours
* Daylight Savings Time Considered?	N

* = User-defined design parameters. All other values are fixed.

TABLE 2. DRY-BULB TEMPERATURE STATISTICS (F)

Month	Absolute Maximum	Average Maximum	Average	Average Minimum	Absolute Minimum
January	60.4	39.3	30.7	21.0	-1.9
February	62.1	42.8	33.1	22.9	7.5
March	75.5	53.9	43.3	32.4	17.1
April	85.5	65.7	55.0	44.3	31.2
May	91.9	73.3	63.5	53.8	40.5
June	93.5	80.8	70.0	58.8	48.8
July	91.0	84.9	75.9	66.5	55.8
August	96.8	85.1	74.3	64.5	49.6
September	91.6	79.3	69.3	60.0	46.5
October	84.7	67.5	56.8	46.7	23.4
November	75.7	56.4	46.6	35.7	17.3
December	59.0	42.7	36.9	30.9	20.5

TABLE 3. DAILY TOTAL SOLAR RADIATION STATISTICS

	[---- Daily Total Solar ---] (BTU/sqft)			[-- Daily Clearness Number --] (Dimensionless)		
Month	Maximum	Average	Minimum	Maximum	Average	Minimum
January	1043.4	609.1	137.7	0.648	0.430	0.107
February	1448.6	815.5	79.9	0.685	0.433	0.048
March	1861.2	1183.4	211.6	0.680	0.473	0.094
April	2371.0	1484.8	247.6	0.717	0.479	0.079
May	2579.4	1712.0	355.4	0.711	0.487	0.104
June	2551.8	1890.8	515.8	0.697	0.514	0.140
July	2398.3	1714.6	629.5	0.657	0.478	0.171
August	2378.9	1696.2	708.2	0.694	0.522	0.227
September	1943.6	1307.6	258.0	0.674	0.482	0.094
October	1546.1	977.2	92.6	0.656	0.469	0.045
November	1143.4	672.4	129.4	0.647	0.437	0.094
December	803.2	488.0	73.1	0.618	0.382	0.057

Notes: * All solar data is daily total flux on a horizontal surface.
* Clearness number is (Daily Total Solar)/(Extraterrestrial Solar)
Values between 0.70 and 0.80 represent clear conditions.

Calendar Name: Baseline	Day Type Assignments Monday = Weekday Tuesday = Weekday Wednesday = Weekday Thursday = Weekday Friday = Weekday Saturday = Saturday Sunday = Sunday Holiday = Saturday
January first is on: Saturday	
Day Type Names Day Type 1 = Weekday Day Type 2 = Saturday Day Type 3 = Sunday	

Holidays

January 1	January 17	February 21	May 30	July 4
September 5	November 24	November 25	December 26	

Schedule Name: People — Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	0	0	0	0	0	0	0	0	50	100	100	100
Weekday	0	0	0	0	0	0	0	0	10	25	40	50
Saturday	0	0	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	10	25

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	100	100	100	100	75	50	0
Weekday	60	60	50	40	40	40	50	50	50	50	50	0
Saturday	10	50	50	50	50	50	50	50	50	50	50	0
Sunday	40	50	50	50	50	50	25	0	0	0	0	0

Schedule Name: Lights — Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	25	25	25	25	25	25	25	50	75	100	100	100
Weekday	25	25	25	25	25	25	25	50	75	100	100	100
Saturday	25	25	25	25	25	25	25	25	25	25	25	25
Sunday	25	25	25	25	25	25	25	25	25	25	25	25

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	50	25	25	25	25	25	25
Weekday	100	100	100	100	100	50	25	25	25	25	25	25
Saturday	25	25	25	25	25	25	25	25	25	25	25	25
Sunday	25	25	25	25	25	25	25	25	25	25	25	25

Schedule Name: People Auditorium — Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	0	0	0	0	0	0	0	0	50	100	100	100
Weekday	0	0	0	0	0	0	0	0	10	25	25	25
Saturday	0	0	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	10	25

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	100	100	100	100	75	50	0
Weekday	25	25	25	25	25	25	25	25	25	50	50	50
Saturday	10	50	50	50	50	50	50	50	50	50	50	0
Sunday	40	50	50	50	50	50	25	0	0	0	0	0

SCHEDULE DATA

Prepared By: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

Schedule Name: Lights - Auditorium Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	15	15	15	15	15	15	15	15	50	100	100	100
Weekday	15	15	15	15	15	15	15	15	10	100	100	100
Saturday	15	15	15	15	15	15	15	15	15	15	15	15
Sunday	15	15	15	15	15	15	15	15	15	15	15	100

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	100	100	100	100	75	50	15
Weekday	100	100	100	100	100	100	100	100	100	50	50	50
Saturday	15	100	100	100	100	100	100	100	100	100	100	15
Sunday	100	100	100	100	100	100	25	15	15	15	15	15

****

WALL TYPE 1: (CUSTOM WALL)

Description..........: Custom Wall
Absorptivity.........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
1/2-in (13 mm) gypsum board	0.50	50.0	0.26	0.45	2.1
8-in (203 mm) LW concrete block	8.00	38.0	0.20	2.02	25.3
Airspace	1.00	0.0	0.00	0.91	0.0
4-in (102 mm) face brick	4.00	125.0	0.22	0.43	41.7
Outside surface resistance	-	-	-	0.33	-
Totals	13.50			4.83	69.1

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

ROOF CONSTRUCTION TYPES

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

ROOF TYPE 1: (CUSTOM ROOF)

Description...........: Rubber Membrane Roof
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
3/4-in Acoustical Ceiling Tile	0.75	18.0	0.14	1.89	1.1
R-19 (RSI-3.3) batt insulation	6.00	0.5	0.20	19.23	0.3
22 gage steel deck	0.03	489.0	0.12	0.00	1.4
R-14 (RSI-2.5) board insulation	2.00	2.0	0.22	13.89	0.3
Membrane Roof	0.00	0.0	0.00	0.00	0.0
Outside surface resistance	-	-	-	0.33	-
Totals	8.78			36.03	3.1

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

WINDOW TYPE 1: (SIMPLE WINDOW)

Window Description.....:	Double Pane Double Hung Windows (By sqft)
Height.................:	1.00 ft
Width..................:	1.00 ft
Overall U-value........:	0.580 BTU/hr/sqft/F
Overall Shade Coeff....:	0.880

ELECTRIC RATE DATA

****

BASIC ELECTRIC RATE INFORMATION

ELECTRIC RATE INFORMATION:	Rate schedule name......:	Virginia Power - Kwh Only
	Currency symbol....................:	$
	Type of rate schedule...............:	Simple
	Flat rate..........................:	0.01968 $/kWh

****

BASIC FUEL RATE INFORMATION

FUEL RATE INFORMATION:	Rate schedule name.......:	Ft. Belvoir District Steam
	Currency symbol..............:	$
	Units of measurement.........:	1000 lb
	Fuel conversion factor.......:	1000.00000 kBTU/1000 lb
	Type of rate schedule........:	Simple
	Flat rate....................:	7.98000 $/1000 lb

FUEL RATE DATA

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

****

BASIC FUEL RATE INFORMATION

FUEL RATE INFORMATION:	Rate schedule name.......:	Washington Gas Rate Schedule 2
	Currency symbol..............:	$
	Units of measurement.........:	Therm
	Fuel conversion factor.......:	100.00000 kBTU/Therm
	Type of rate schedule........:	Simple
	Flat rate....................:	0.60790 $/Therm

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

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GENERAL		**SCHEDULES**	
Name......:	Basement Classrooms	Lighting....:	Lights
Floor Area......:	8330.0 sqft	Task Lights.:	Lights
Building Weight.:	70.0 lb/sqft	People......:	People
Windows Shaded..?	N	Equipment...:	People
Partitions Used.?	N	Misc. Sens..:	People
LIGHTING		Misc. Latent:	People
Overhead Fixture:	Recessed	**INFILTRATION**	
Lamp Wattage....:	3.00 W/sqft	Cooling.....:	0.00 CFM/sqft
Ballast Mult....:	1.00	Heating.....:	0.00 CFM/sqft
Task Lighting...:	0.00 W/sqft	Typical.....:	0.00 CFM/sqft
PEOPLE		When Fan On.?	N
Occupancy.......:	200.0 sqft/per	**FLOOR**	
Activity Level..:	Office Work	Type........:	Slab Below Grade
Sensible........:	245.0 BTU/hr	Perimeter.............:	400.0 ft
Latent..........:	205.0 BTU/hr	Slab Floor Area.......:	8330.0 sqft
OTHER LOADS		Floor R-Value.........:	2.40
Equipment.......:	0.50 W/sqft	Insulation R-value....:	0.00
Misc. Sensible..:	0.0 BTU/hr	Depth of Insulation...:	0.0 ft
Misc. Latent....:	0.0 BTU/hr	Depth Below Grade.....:	6.0 ft

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	1831.0	1	1	522	-	1	0	-	N
S	2134.0	1	1	421	-	1	0	-	N
E	1040.0	1	1	0	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

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```
***************************************************************************
GENERAL                                   SCHEDULES
 Name......: Basement Offices              Lighting....: Lights
 Floor Area......:    1372.0 sqft          Task Lights.: Lights
 Building Weight.:      70.0 lb/sqft       People......: People
 Windows Shaded..?         N               Equipment...: People
 Partitions Used.?         N               Misc. Sens..: People
LIGHTING                                   Misc. Latent: People
 Overhead Fixture: Recessed               INFILTRATION
 Lamp Wattage....:      3.00 W/sqft        Cooling.....:       0.00 CFM/sqft
 Ballast Mult....:      1.00               Heating.....:       0.00 CFM/sqft
 Task Lighting...:      0.00 W/sqft        Typical.....:       0.00 CFM/sqft
PEOPLE                                     When Fan On.?          N
 Occupancy.......:     345.0 sqft/per     FLOOR
 Activity Level..: Office Work             Type........:Slab Below Grade
 Sensible........:     245.0 BTU/hr        Perimeter............:     400.0 ft
 Latent..........:     205.0 BTU/hr        Slab Floor Area.......:   1372.0 sqft
OTHER LOADS                                Floor R-Value.........:     2.40
 Equipment.......:      1.00 W/sqft        Insulation R-value....:     0.00
 Misc. Sensible..:       0.0 BTU/hr        Depth of Insulation...:      0.0 ft
 Misc. Latent....:       0.0 BTU/hr        Depth Below Grade.....:      6.0 ft
```

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	1275.0	1	1	280	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

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SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

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****

GENERAL
- Name......: Classrm 1&6 (Typ 1 & 2)
- Floor Area......: 2600.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 65.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	858.0	1	1	240	-	1	0	-	N
S	858.0	1	1	240	-	1	0	-	N
E	520.0	1	1	0	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

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SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

****

GENERAL
- Name......: Classrm 2&3 (Typ 1 & 2)
- Floor Area......: 2600.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 65.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	858.0	1	1	240	-	1	0	-	N
S	858.0	1	1	240	-	1	0	-	N
W	520.0	1	1	0	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

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****

GENERAL
- Name......: Classrm 4 (Typ 1 & 2)
- Floor Area......: 2600.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 65.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	650.0	1	1	200	-	1	0	-	N
E	845.0	1	1	605	-	1	0	-	N
N	520.0	1	1	0	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

SPACE DESCRIPTION

****

GENERAL
Name......: Classrm 5 (Typ 1 & 2)
Floor Area......: 2600.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 3.00 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 65.0 sqft/per
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 0.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	650.0	1	1	200	-	1	0	-	N
W	845.0	1	1	605	-	1	0	-	N
N	520.0	1	1	0	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT

12-30-94

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GENERAL
- Name......: North Offices (Typ 1 & 2
- Floor Area......: 588.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 147.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

===

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	520.0	1	1	160	-	1	0	-	N

===

No roof or door data for this space.

===

No partition data for this space.

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SPACE DESCRIPTION

****

GENERAL
Name......: East Offices (Typ 1 & 2)
Floor Area......: 1372.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 3.00 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 275.0 sqft/per
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 2.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	1274.0	1	1	376	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

C-167

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

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GENERAL                                   SCHEDULES
 Name......: South Offices (Typ 1 & 2      Lighting....: Lights
 Floor Area......:    2294.0 sqft          Task Lights.: Lights
 Building Weight.:      70.0 lb/sqft       People......: People
 Windows Shaded..?         N               Equipment...: People
 Partitions Used.?         N               Misc. Sens..: People
LIGHTING                                   Misc. Latent: People
 Overhead Fixture: Recessed               INFILTRATION
 Lamp Wattage....:      3.00 W/sqft        Cooling.....:       0.00 CFM/sqft
 Ballast Mult....:      1.00               Heating.....:       0.00 CFM/sqft
 Task Lighting...:      0.00 W/sqft        Typical.....:       0.00 CFM/sqft
PEOPLE                                     When Fan On.?          N
 Occupancy.......:     229.0 sqft/per     FLOOR
 Activity Level..: Office Work             Type........:Above Conditioned Space
 Sensible........:     245.0 BTU/hr
 Latent..........:     205.0 BTU/hr
OTHER LOADS
 Equipment.......:      2.00 W/sqft
 Misc. Sensible..:       0.0 BTU/hr
 Misc. Latent....:       0.0 BTU/hr
```

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	182.0	1	1	0	-	1	0	-	N
S	1586.0	1	1	210	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

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SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

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****

GENERAL
- Name......: West Offices (Typ 1 & 2)
- Floor Area......: 1372.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 275.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	1274.0	1	1	300	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

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SPACE DESCRIPTION


```
*******************************************************************************
GENERAL                                      SCHEDULES
 Name......: Cloak Rm (Typ 4/Flr)             Lighting....: Lights
 Floor Area......:     1040.0 sqft            Task Lights.: Lights
 Building Weight.:       70.0 lb/sqft         People......: People
 Windows Shaded..?          N                 Equipment...: People
 Partitions Used.?          N                 Misc. Sens..: People
LIGHTING                                      Misc. Latent: People
 Overhead Fixture: Recessed                  INFILTRATION
 Lamp Wattage....:       3.00 W/sqft          Cooling.....:      0.00 CFM/sqft
 Ballast Mult....:       1.00                 Heating.....:      0.00 CFM/sqft
 Task Lighting...:       0.00 W/sqft          Typical.....:      0.00 CFM/sqft
PEOPLE                                        When Fan On.?         N
 Occupancy.......:      200.0 sqft/per       FLOOR
 Activity Level..: Office Work                Type........:Above Conditioned Space
 Sensible........:      245.0 BTU/hr
 Latent..........:      205.0 BTU/hr
OTHER LOADS
 Equipment.......:       0.00 W/sqft
 Misc. Sensible..:        0.0 BTU/hr
 Misc. Latent....:        0.0 BTU/hr
===============================================================================
No external wall or window data for this space.
===============================================================================
No roof or door data for this space.
===============================================================================
No partition data for this space.
===============================================================================
```

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

```
GENERAL                                  SCHEDULES
 Name......: Auditorium                   Lighting....: Lights
 Floor Area......:    9272.0 sqft         Task Lights.: Lights
 Building Weight.:      70.0 lb/sqft      People......: People
 Windows Shaded..?         N              Equipment...: People
 Partitions Used.?         N              Misc. Sens..: People
LIGHTING                                  Misc. Latent: People
 Overhead Fixture: Recessed              INFILTRATION
 Lamp Wattage....:      2.50 W/sqft       Cooling.....:      0.00 CFM/sqft
 Ballast Mult....:      1.00              Heating.....:      0.00 CFM/sqft
 Task Lighting...:      0.00 W/sqft       Typical.....:      0.00 CFM/sqft
PEOPLE                                    When Fan On.?        N
 Occupancy.......:      22.0 sqft/per   FLOOR
 Activity Level..: Seated at Rest         Type........:Above Conditioned Space
 Sensible........:     230.0 BTU/hr
 Latent..........:     120.0 BTU/hr
OTHER LOADS
 Equipment.......:      0.00 W/sqft
 Misc. Sensible..:       0.0 BTU/hr
 Misc. Latent....:       0.0 BTU/hr
```

===

No external wall or window data for this space.

===

No roof or door data for this space.

===

No partition data for this space.

===

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SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

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****

GENERAL
 Name......: Classrm 1&6 (3rd Flr)
 Floor Area......: 2600.0 sqft
 Building Weight.: 70.0 lb/sqft
 Windows Shaded..? N
 Partitions Used.? N

LIGHTING
 Overhead Fixture: Recessed
 Lamp Wattage....: 3.00 W/sqft
 Ballast Mult....: 1.00
 Task Lighting...: 0.00 W/sqft

PEOPLE
 Occupancy.......: 65.0 sqft/per
 Activity Level..: Office Work
 Sensible........: 245.0 BTU/hr
 Latent..........: 205.0 BTU/hr

OTHER LOADS
 Equipment.......: 0.00 W/sqft
 Misc. Sensible..: 0.0 BTU/hr
 Misc. Latent....: 0.0 BTU/hr

SCHEDULES
 Lighting....: Lights
 Task Lights.: Lights
 People......: People
 Equipment...: People
 Misc. Sens..: People
 Misc. Latent: People

INFILTRATION
 Cooling.....: 0.00 CFM/sqft
 Heating.....: 0.00 CFM/sqft
 Typical.....: 0.00 CFM/sqft
 When Fan On.? N

FLOOR
 Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	858.0	1	1	210	-	1	0	-	N
S	858.0	1	1	210	-	1	0	-	N
E	520.0	1	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	2600.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: Classrm 2&3 (3rd Flr)
- Floor Area......: 2600.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 65.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	858.0	1	1	210	-	1	0	-	N
S	858.0	1	1	210	-	1	0	-	N
W	520.0	1	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	2600.0	1	1	0

No partition data for this space.

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SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

GENERAL
- Name......: Classrm 4 (3rd Flr)
- Floor Area......: 2600.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 65.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	650.0	1	1	131	-	1	0	-	N
E	858.0	1	1	158	-	1	0	-	N
N	520.0	1	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	2600.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: Classrm 5 (3rd Flr)
- Floor Area......: 2600.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 65.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	650.0	1	1	131	-	1	0	-	N
W	858.0	1	1	158	-	1	0	-	N
N	520.0	1	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	2600.0	1	1	0

No partition data for this space.

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SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

****

GENERAL
- Name......: North Offices (3rd Flr)
- Floor Area......: 588.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 147.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	520.0	1	1	105	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	588.0	1	1	0

No partition data for this space.

****

GENERAL
Name......: East Offices (3rd Flr)
Floor Area......: 1372.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 3.00 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 275.0 sqft/per
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 2.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	1274.0	1	1	235	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1372.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

****

GENERAL
- Name......: South Offices (3rd Flr)
- Floor Area......: 1708.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 155.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

==

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	182.0	1	1	0	-	1	0	-	N
S	1586.0	1	1	250	-	1	0	-	N

==

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1708.0	1	1	0

==

No partition data for this space.

==

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: West Offices (3rd Flr)
- Floor Area......: 1372.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 275.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	1274.0	1	1	235	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1372.0	1	1	0

No partition data for this space.

C-179

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: Inner Offices North
- Floor Area......: 910.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 182.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	686.0	1	1	286	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	910.0	1	1	0

No partition data for this space.

C-180

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: Inner Offices East
- Floor Area......: 1320.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 189.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	1222.0	1	1	587	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1320.0	1	1	0

No partition data for this space.

C-181

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: Inner Offices South
- Floor Area......: 792.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 198.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	690.0	1	1	305	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	792.0	1	1	0

No partition data for this space.

C-182

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: Inner Offices West
- Floor Area......: 1320.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 189.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	1222.0	1	1	587	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1320.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT — 12-30-94

HAP v3.04 — Page 1

****

GENERAL
- Name......: South Offices (2nd Flr)
- Floor Area......: 1320.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 155.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	740.0	1	1	649	-	1	0	-	N
S	740.0	1	1	649	-	1	0	-	N
E	289.0	1	1	0	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

C-184

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04 Page 1

****

GENERAL
Name......: Typical Stair Tower E
Floor Area......: 1200.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 1.00 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 0 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 0.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: People
Task Lights.: People
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	1210.0	1	1	250	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	300.0	1	1	0

No partition data for this space.

C-185

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04

GENERAL
Name......: Typical Stair Tower W
Floor Area......: 1200.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 1.00 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 0 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 0.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: People
Task Lights.: People
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	880.0	1	1	210	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	300.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04 Page 1

****

GENERAL
- Name......: Corridors
- Floor Area......: 10000.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 1.50 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: People
- Task Lights.: People
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

==

No external wall or window data for this space.

==

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	3568.0	1	1	0

==

No partition data for this space.

==

C-187

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04

****

GENERAL
- Name......: Cloak Rm 3rd Flr (Typ 4)
- Floor Area......: 1040.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

===

No external wall or window data for this space.

===

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1040.0	1	1	0

===

No partition data for this space.

===

C-188

AIR SYSTEM INPUT DATA

Name: Auditorium - Baseline 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Auditorium - Baseline
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

===

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Is Central Cooling Used.......? Y
Supply Air....................: 20000.0 CFM
Coil Bypass Factor............: 0.100
Fan Cycled for Cooling........? N
Supply Air Reset..............: Not Used
HEATING SYSTEM DATA
Is Central Heating Used.......? Y
Fan Cycled for Heating........? N
Supply Air Reset..............: Not Used
OUTDOOR VENTILATION DATA
Type of Control...............: Constant Airflow Rate
Design Ventilation Airflow....: 5000.0 CFM
Dampers Open During Unocc Per.: N
Damper Leak Rate..............: 2 %
SUPPLY DUCT DATA
Duct Heat Gain................: 2 %
Duct Leakage Rate.............: 5 %
RETURN PLENUM DATA
Is a Return Plenum Used.......? N
SUPPLY FAN DATA
Fan Type......................: Backward Inclined or Airfoil
Configuration.................: Draw-Thru
Fan Total Static..............: 2.00 in.wg.
Fan Efficiency................: 54 %
RETURN FAN DATA
Fan Type......................: None
OUTDOOR AIR ECONOMIZER
Outdoor Economizer Type.......: None
PREHEAT COIL
Preheat Coil Used.............? N
PRECOOL COIL
Precool Coil Used.............? N
HUMIDIFICATION
Humidification System Used....? N
DEHUMIDIFICATION
Dehumidification System Used..? N
VENTILATION HEAT RECLAIM
Reclaim Unit Type.............: None
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %

===

AIR SYSTEM INPUT DATA

Name: Auditorium - Baseline | 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV | HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT |

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type.........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday.................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? Y

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

1. SYSTEM NAME AND TYPE

Name............:	Classroom 1 & 6 (Flr 1 & 2)
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	55.0 F
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	1650.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan Total Static..............:	1.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type...........:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday...............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday..............																								
Sunday................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

```
Name: Classroom 2 & 3 (Flr 1 & 2)                          12-30-94
Type: CONSTANT VOLUME - Single Zone CAV                    HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT                          Page  1
*********************************************************************

1. SYSTEM NAME AND TYPE
---------------------------------------------------------------------
  Name............: Classroom 2 & 3 (Flr 1 & 2)
  Type............: CONSTANT VOLUME - Single Zone CAV
  Number of Zones.:  1
=====================================================================

2. SYSTEM DESCRIPTION
---------------------------------------------------------------------
COOLING SYSTEM DATA
 Is Central Cooling Used.......?              Y
 Supply Air....................:           55.0 F
 Coil Bypass Factor............:          0.100
 Fan Cycled for Cooling........?              N
 Supply Air Reset..............:     Not Used
HEATING SYSTEM DATA
 Is Central Heating Used.......?              Y
 Fan Cycled for Heating........?              N
 Supply Air Reset..............:     Not Used
OUTDOOR VENTILATION DATA
 Type of Control...............:     Constant Airflow Rate
 Design Ventilation Airflow....:         1650.0 CFM
 Dampers Open During Unocc Per.:              N
 Damper Leak Rate..............:              2 %
SUPPLY DUCT DATA
 Duct Heat Gain................:              2 %
 Duct Leakage Rate.............:              5 %
RETURN PLENUM DATA
 Is a Return Plenum Used.......?              N
SUPPLY FAN DATA
 Fan Type......................:     Forward Curved
 Configuration.................:     Draw-Thru
 Fan Total Static..............:           1.00 in.wg.
 Fan Efficiency................:             54 %
RETURN FAN DATA
 Fan Type......................:     None
OUTDOOR AIR ECONOMIZER
 Outdoor Economizer Type.......:     None
PREHEAT COIL
 Preheat Coil Used.............?              N
PRECOOL COIL
 Precool Coil Used.............?              N
HUMIDIFICATION
 Humidification System Used....?              N
DEHUMIDIFICATION
 Dehumidification System Used..?              N
VENTILATION HEAT RECLAIM
 Reclaim Unit Type.............:     None
SAFETY FACTORS
 Sensible Cooling Factor.......:              0 %
 Latent Cooling Factor.........:              0 %
 Heating Factor................:              0 %
=====================================================================
```

AIR SYSTEM INPUT DATA

Name: Classroom 2 & 3 (Flr 1 & 2) — 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT —

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday...............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday..............																								
Sunday................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

****

1. SYSTEM NAME AND TYPE

Name............:	Classroom 4 (Flr 1 & 2)
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	55.0 F
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	1650.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan Total Static..............:	1.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

==

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday................									X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Classroom 5 (Flr 1 & 2) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SYSTEM NAME AND TYPE

Name............:	Classroom 5 (Flr 1 & 2)
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air...................:	55.0 F
Coil Bypass Factor...........:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	1650.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan Total Static..............:	1.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: Classroom 5 (Flr 1 & 2) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday................									X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

C-198

AIR SYSTEM INPUT DATA

Name: Classrooms 1 & 6 (3rd Flr) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Classrooms 1 & 6 (3rd Flr)
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

===

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air...................:	55.0 F
Coil Bypass Factor...........:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	1650.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan Total Static..............:	1.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used............?	N
PRECOOL COIL	
Precool Coil Used............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

===

AIR SYSTEM INPUT DATA

Name: Classrooms 1 & 6 (3rd Flr) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency..........(%):	-	
Zone Terminal Type...........:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday...............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday..............																								
Sunday................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

C-200

AIR SYSTEM INPUT DATA

Name: Classrooms 2 & 3 (3rd Flr)	12-30-94
Type: CONSTANT VOLUME - Single Zone CAV	HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT	Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Classrooms 2 & 3 (3rd Flr)
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

===

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	55.0 F
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	1650.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan Total Static..............:	1.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

===

C-201

3. ZONE DATA

ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0
Unoccupied Cooling..(F):	85.0
Occupied Heating....(F):	70.0
Unoccupied Heating..(F):	55.0
Throttling Range....(F):	3.0
Zone Heating Unit Type........:	None
Trip Temperature.........(F):	-
Design Supply Temperature(F):	-
Fan Total Static....(in.wg.):	-
Fan Efficiency...........(%):	-
Zone Terminal Type...........:	Diffuser
Reheat Coil.................?	N
Direct Exhaust Airflow...(CFM):	0.0
Direct Exhaust Fan kW.....(kW):	0.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday................									X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

****

1. SYSTEM NAME AND TYPE

Name............:	Classroom 4 (3rd Flr)
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	55.0 F
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	1650.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan Total Static..............:	1.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: Classroom 4 (3rd Flr) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

3. ZONE DATA

ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0
Unoccupied Cooling..(F):	85.0
Occupied Heating....(F):	70.0
Unoccupied Heating..(F):	55.0
Throttling Range....(F):	3.0
Zone Heating Unit Type........:	None
Trip Temperature.........(F):	-
Design Supply Temperature(F):	-
Fan Total Static....(in.wg.):	-
Fan Efficiency..........(%):	-
Zone Terminal Type............:	Diffuser
Reheat Coil.................?	N
Direct Exhaust Airflow...(CFM):	0.0
Direct Exhaust Fan kW.....(kW):	0.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday...............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday..............																								
Sunday................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Classroom 5 (3rd Flr) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Classroom 5 (3rd Flr)
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

===

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Is Central Cooling Used.......? Y
Supply Air....................: 55.0 F
Coil Bypass Factor............: 0.100
Fan Cycled for Cooling........? N
Supply Air Reset..............: Not Used
HEATING SYSTEM DATA
Is Central Heating Used.......? Y
Fan Cycled for Heating........? N
Supply Air Reset..............: Not Used
OUTDOOR VENTILATION DATA
Type of Control...............: Constant Airflow Rate
Design Ventilation Airflow....: 1650.0 CFM
Dampers Open During Unocc Per.: N
Damper Leak Rate..............: 2 %
SUPPLY DUCT DATA
Duct Heat Gain................: 2 %
Duct Leakage Rate.............: 5 %
RETURN PLENUM DATA
Is a Return Plenum Used.......? N
SUPPLY FAN DATA
Fan Type......................: Forward Curved
Configuration.................: Draw-Thru
Fan Total Static..............: 1.00 in.wg.
Fan Efficiency................: 54 %
RETURN FAN DATA
Fan Type......................: None
OUTDOOR AIR ECONOMIZER
Outdoor Economizer Type.......: None
PREHEAT COIL
Preheat Coil Used.............? N
PRECOOL COIL
Precool Coil Used.............? N
HUMIDIFICATION
Humidification System Used....? N
DEHUMIDIFICATION
Dehumidification System Used..? N
VENTILATION HEAT RECLAIM
Reclaim Unit Type.............: None
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %

===

AIR SYSTEM INPUT DATA

Name: Classroom 5 (3rd Flr) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 2

****

3. ZONE DATA

ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0
Unoccupied Cooling..(F):	85.0
Occupied Heating....(F):	70.0
Unoccupied Heating..(F):	55.0
Throttling Range....(F):	3.0
Zone Heating Unit Type........:	None
Trip Temperature.........(F):	-
Design Supply Temperature(F):	-
Fan Total Static....(in.wg.):	-
Fan Efficiency...........(%):	-
Zone Terminal Type...........:	Diffuser
Reheat Coil.................?	N
Direct Exhaust Airflow...(CFM):	0.0
Direct Exhaust Fan kW.....(kW):	0.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday...............									X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday..............																								
Sunday................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

C-206

1. SYSTEM NAME AND TYPE

Name............: Perimeter Fan Coil Units - Base
Type............: TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.: 14

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Supply Air....................: 55.0 F
Fan Cycled for Cooling........? N
Coil Bypass Factor............: 0.100
HEATING SYSTEM DATA
Fan Cycled for Heating........? N
OUTDOOR VENTILATION DATA
Common Ventilation System Used? N
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %
OUTDOOR VENTILATION DATA
Type of Control...............: Constant Airflow Rate
Design Ventilation Airflow....: 0.0 CFM/person

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Terminal Type............:	Fan Coil	
Fan Total Static....(in.wg.):	0.25	
Fan Efficiency..........(%):	54	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday.................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

```
                         AIR SYSTEM INPUT DATA
Name: Basement Classrooms (2)-Baseline                          12-30-94
Type: CONSTANT VOLUME - Single Zone CAV                         HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT                             Page  1
**************************************************************************

1. SYSTEM NAME AND TYPE
--------------------------------------------------------------------------
  Name............: Basement Classrooms (2)-Baseline
  Type............: CONSTANT VOLUME - Single Zone CAV
  Number of Zones.:  1
==========================================================================

2. SYSTEM DESCRIPTION
--------------------------------------------------------------------------
COOLING SYSTEM DATA
 Is Central Cooling Used.......?               Y
 Supply Air....................:            55.0 F
 Coil Bypass Factor............:           0.100
 Fan Cycled for Cooling........?               N
 Supply Air Reset..............:     Not Used
HEATING SYSTEM DATA
 Is Central Heating Used.......?               Y
 Fan Cycled for Heating........?               N
 Supply Air Reset..............:     Not Used
OUTDOOR VENTILATION DATA
 Type of Control...............:     Constant Airflow Rate
 Design Ventilation Airflow....:         1600.0 CFM
 Dampers Open During Unocc Per.:               N
 Damper Leak Rate..............:               2 %
SUPPLY DUCT DATA
 Duct Heat Gain................:               2 %
 Duct Leakage Rate.............:               5 %
RETURN PLENUM DATA
 Is a Return Plenum Used.......?               N
SUPPLY FAN DATA
 Fan Type......................:     Forward Curved
 Configuration.................:     Draw-Thru
 Fan Total Static..............:            1.00 in.wg.
 Fan Efficiency................:              54 %
RETURN FAN DATA
 Fan Type......................:     None
OUTDOOR AIR ECONOMIZER
 Outdoor Economizer Type.......:     None
PREHEAT COIL
 Preheat Coil Used.............?               N
PRECOOL COIL
 Precool Coil Used.............?               N
HUMIDIFICATION
 Humidification System Used....?               N
DEHUMIDIFICATION
 Dehumidification System Used..?               N
VENTILATION HEAT RECLAIM
 Reclaim Unit Type.............:     None
SAFETY FACTORS
 Sensible Cooling Factor.......:               0 %
 Latent Cooling Factor.........:               0 %
 Heating Factor................:               0 %
==========================================================================
```

AIR SYSTEM INPUT DATA

Name: Basement Classrooms (2)-Baseline 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Auditorium - PLC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Auditorium - PLC
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	20000.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	5000.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Backward Inclined or Airfoil
Configuration.................:	Draw-Thru
Fan Total Static..............:	2.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

==

AIR SYSTEM INPUT DATA

Name: Auditorium - PLC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type...........:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday................								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

C-212

AIR SYSTEM INPUT DATA

****

1. SYSTEM NAME AND TYPE

Name............: Perimeter Fan Coil Units - PLC
Type............: TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.: 14

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Supply Air...................: 55.0 F
Fan Cycled for Cooling........? N
Coil Bypass Factor............: 0.100
HEATING SYSTEM DATA
Fan Cycled for Heating........? N
OUTDOOR VENTILATION DATA
Common Ventilation System Used? N
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %
OUTDOOR VENTILATION DATA
Type of Control...............: Constant Airflow Rate
Design Ventilation Airflow....: 0.0 CFM/person

==

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Terminal Type...........:	Fan Coil	
Fan Total Static....(in.wg.):	0.25	
Fan Efficiency..........(%):	54	

==

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday................								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Basement Classrooms (2) - PLC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

1. SYSTEM NAME AND TYPE

Name............: Basement Classrooms (2) - PLC
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	55.0 F
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	1600.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan Total Static..............:	1.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

==

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday................								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

****

1. SYSTEM NAME AND TYPE

Name............:	Auditorium - DDC
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	20000.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	5000.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Backward Inclined or Airfoil
Configuration.................:	Draw-Thru
Fan Total Static..............:	2.00 in.wg.
Fan Efficiency................:	54 %
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	Integrated Enthalpy
OA Upper Cutoff Temp..........:	95.0 F
OA Lower Cutoff Temp..........:	0.0 F
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: Auditorium - DDC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday...............								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday..............																								
Sunday................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

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```
                         AIR SYSTEM INPUT DATA
Name: Perimeter Fan Coil Units - DDC                            12-30-94
Type: TERMINAL UNITS  - 2-Pipe Fan Coils                        HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT                            Page  1
************************************************************************

1. SYSTEM NAME AND TYPE
------------------------------------------------------------------------
  Name............: Perimeter Fan Coil Units - DDC
  Type............: TERMINAL UNITS  - 2-Pipe Fan Coils
  Number of Zones.: 14
========================================================================

2. SYSTEM DESCRIPTION
------------------------------------------------------------------------
COOLING SYSTEM DATA
 Supply Air....................:          55.0 F
 Fan Cycled for Cooling........?             N
 Coil Bypass Factor............:         0.100
HEATING SYSTEM DATA
 Fan Cycled for Heating........?             N
OUTDOOR VENTILATION DATA
 Common Ventilation System Used?             N
SAFETY FACTORS
 Sensible Cooling Factor.......:             0 %
 Latent Cooling Factor.........:             0 %
 Heating Factor................:             0 %
OUTDOOR VENTILATION DATA
 Type of Control...............:    Constant Airflow Rate
 Design Ventilation Airflow....:           0.0 CFM/person
========================================================================

3. ZONE DATA
------------------------------------------------------------------------
ZONE                                         1   (All Zones the Same)
T-Stat Occupied Cooling....(F):           75.0
       Unoccupied Cooling..(F):           85.0
       Occupied Heating....(F):           70.0
       Unoccupied Heating..(F):           55.0
       Throttling Range....(F):            3.0
Zone Terminal Type............:       Fan Coil
  Fan Total Static....(in.wg.):           0.25
  Fan Efficiency..........(%):              54
========================================================================
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AIR SYSTEM INPUT DATA

Name: Perimeter Fan Coil Units - DDC
Type: TERMINAL UNITS - 2-Pipe Fan Coils
Prepared by: EINHORN YAFFEE PRESCOTT

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday................								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Basement Classrooms (2) - DDC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Basement Classrooms (2) - DDC
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air...................:	55.0 F
Coil Bypass Factor...........:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset.............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset.............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control..............:	Constant Airflow Rate
Design Ventilation Airflow....:	1650.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate.............:	2 %
SUPPLY DUCT DATA	
Duct Heat Gain...............:	2 %
Duct Leakage Rate............:	5 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type.....................:	Forward Curved
Configuration................:	Draw-Thru
Fan Total Static.............:	1.00 in.wg.
Fan Efficiency...............:	54 %
RETURN FAN DATA	
Fan Type.....................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used............?	N
PRECOOL COIL	
Precool Coil Used............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor...............:	0 %

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AIR SYSTEM INPUT DATA

Name: Basement Classrooms (2) - DDC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 2

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Weekday................								X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
12. Auditorium	1		

AIR SYSTEM INPUT DATA

Name: Classroom 1 & 6 (Flr 1 & 2) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
3. Classrm 1&6 (Typ 1 & 2)	1		

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AIR SYSTEM INPUT DATA

Name: Classroom 2 & 3 (Flr 1 & 2) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
4. Classrm 2&3 (Typ 1 & 2)	1		

AIR SYSTEM INPUT DATA

Name: Classroom 4 (Flr 1 & 2) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
5. Classrm 4 (Typ 1 & 2)	1		

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AIR SYSTEM INPUT DATA

Name: Classroom 5 (Flr 1 & 2) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
6. Classrm 5 (Typ 1 & 2)	1		

AIR SYSTEM INPUT DATA

Name: Classrooms 1 & 6 (3rd Flr) 12-30-94

Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04

Prepared by: EINHORN YAFFEE PRESCOTT

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
13. Classrm 1&6 (3rd Flr)	1		

AIR SYSTEM INPUT DATA

Name: Classrooms 2 & 3 (3rd Flr) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
14. Classrm 2&3 (3rd Flr)	1		

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AIR SYSTEM INPUT DATA

Name: Classroom 4 (3rd Flr) 12-30-94

Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04

Prepared by: EINHORN YAFFEE PRESCOTT

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
15. Classrm 4 (3rd Flr)	1		

AIR SYSTEM INPUT DATA

Name: Classroom 5 (3rd Flr) 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
16. Classrm 5 (3rd Flr)	1		

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AIR SYSTEM INPUT DATA

Name: Perimeter Fan Coil Units - Base 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
2. Basement Offices	1		
SPACES IN ZONE 2 (Zone 2)			
7. North Offices (Typ 1 & 2	2		
SPACES IN ZONE 3 (Zone 3)			
8. East Offices (Typ 1 & 2)	2		
SPACES IN ZONE 4 (Zone 4)			
9. South Offices (Typ 1 & 2	2		
SPACES IN ZONE 5 (Zone 5)			
10. West Offices (Typ 1 & 2)	2		
SPACES IN ZONE 6 (Zone 6)			
17. North Offices (3rd Flr)	1		
SPACES IN ZONE 7 (Zone 7)			
18. East Offices (3rd Flr)	1		
SPACES IN ZONE 8 (Zone 8)			
19. South Offices (3rd Flr)	1		
SPACES IN ZONE 9 (Zone 9)			
20. West Offices (3rd Flr)	1		
SPACES IN ZONE 10 (Zone 10)			
21. Inner Offices North	1		
SPACES IN ZONE 11 (Zone 11)			
22. Inner Offices East	1		
SPACES IN ZONE 12 (Zone 12)			
23. Inner Offices South	1		
SPACES IN ZONE 13 (Zone 13)			
24. Inner Offices West	1		

1. SPACE SELECTION (CONTINUED)

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 14 (Zone 14)			
25. South Offices (2nd Flr)	1		

AIR SYSTEM INPUT DATA

Name: Basement Classrooms (2)-Baseline 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. Basement Classrooms	1		

AIR SYSTEM INPUT DATA

Name: Auditorium - PLC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
12. Auditorium	1		

AIR SYSTEM INPUT DATA

Name: Perimeter Fan Coil Units - PLC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
2. Basement Offices	1		
SPACES IN ZONE 2 (Zone 2)			
7. North Offices (Typ 1 & 2	2		
SPACES IN ZONE 3 (Zone 3)			
8. East Offices (Typ 1 & 2)	2		
SPACES IN ZONE 4 (Zone 4)			
9. South Offices (Typ 1 & 2	2		
SPACES IN ZONE 5 (Zone 5)			
10. West Offices (Typ 1 & 2)	2		
SPACES IN ZONE 6 (Zone 6)			
17. North Offices (3rd Flr)	1		
SPACES IN ZONE 7 (Zone 7)			
18. East Offices (3rd Flr)	1		
SPACES IN ZONE 8 (Zone 8)			
19. South Offices (3rd Flr)	1		
SPACES IN ZONE 9 (Zone 9)			
20. West Offices (3rd Flr)	1		
SPACES IN ZONE 10 (Zone 10)			
21. Inner Offices North	1		
SPACES IN ZONE 11 (Zone 11)			
22. Inner Offices East	1		
SPACES IN ZONE 12 (Zone 12)			
23. Inner Offices South	1		
SPACES IN ZONE 13 (Zone 13)			
24. Inner Offices West	1		

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1. SPACE SELECTION (CONTINUED)

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 14 (Zone 14)			
25. South Offices (2nd Flr)	1		

AIR SYSTEM INPUT DATA

Name: Basement Classrooms (2) - PLC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. Basement Classrooms	1		

AIR SYSTEM INPUT DATA

Name: Auditorium - DDC 12-30-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
12. Auditorium	1		

AIR SYSTEM INPUT DATA

Name: Perimeter Fan Coil Units - DDC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
2. Basement Offices	1		
SPACES IN ZONE 2 (Zone 2)			
7. North Offices (Typ 1 & 2	2		
SPACES IN ZONE 3 (Zone 3)			
8. East Offices (Typ 1 & 2)	2		
SPACES IN ZONE 4 (Zone 4)			
9. South Offices (Typ 1 & 2	2		
SPACES IN ZONE 5 (Zone 5)			
10. West Offices (Typ 1 & 2)	2		
SPACES IN ZONE 6 (Zone 6)			
17. North Offices (3rd Flr)	1		
SPACES IN ZONE 7 (Zone 7)			
18. East Offices (3rd Flr)	1		
SPACES IN ZONE 8 (Zone 8)			
19. South Offices (3rd Flr)	1		
SPACES IN ZONE 9 (Zone 9)			
20. West Offices (3rd Flr)	1		
SPACES IN ZONE 10 (Zone 10)			
21. Inner Offices North	1		
SPACES IN ZONE 11 (Zone 11)			
22. Inner Offices East	1		
SPACES IN ZONE 12 (Zone 12)			
23. Inner Offices South	1		
SPACES IN ZONE 13 (Zone 13)			
24. Inner Offices West	1		

1. SPACE SELECTION (CONTINUED)

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 14 (Zone 14)			
25. South Offices (2nd Flr)	1		

AIR SYSTEM INPUT DATA

Name: Stair Towers 01-06-95
Type: TERMINAL UNITS - Convective Htg and Clg HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SYSTEM NAME AND TYPE

Name............: Stair Towers
Type............: TERMINAL UNITS - Convective Htg and Clg
Number of Zones.: 2

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Is Cooling System Used........? N
HEATING SYSTEM DATA
Is Heating System Used........? Y
OUTDOOR VENTILATION DATA
Common Ventilation System Used? N
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %

3. ZONE DATA

ZONE 1 (All Zones the Same)
T-Stat Zone Setpoint.......(F): 70.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX

AIR SYSTEM INPUT DATA

Name: Corridors 01-06-95
Type: TERMINAL UNITS - Convective Htg and Clg HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SYSTEM NAME AND TYPE

Name............: Corridors
Type............: TERMINAL UNITS - Convective Htg and Clg
Number of Zones.: 3

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Is Cooling System Used........? N
HEATING SYSTEM DATA
Is Heating System Used........? Y
OUTDOOR VENTILATION DATA
Common Ventilation System Used? N
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %

3. ZONE DATA

ZONE 1 (All Zones the Same)
T-Stat Zone Setpoint.......(F): 70.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX

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AIR SYSTEM INPUT DATA

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
27. Typical Stair Tower E	2		
SPACES IN ZONE 2 (Zone 2)			
28. Typical Stair Tower W	2		

AIR SYSTEM INPUT DATA

Name: Corridors 01-06-95
Type: TERMINAL UNITS - Convective Htg and Clg HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
29. Corridors	1		
SPACES IN ZONE 2 (Zone 2)			
11. Cloak Rm (Typ 4/Flr)	8	29. Corridors	1
SPACES IN ZONE 3 (Zone 3)			
29. Corridors	1	30. Cloak Rm 3rd Flr (Typ 4)	4

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	Cooling Plant - Baseline
Classification..............:	Cooling
Type........................:	Water-Cooled Chiller
Type of simulation model....:	Computer-Generated
Type of chiller.............:	W/C Centrifugal
Type of heat rejection model:	Open Cooling Tower Model

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
1. Auditorium - Baseline...........	(SZ CAV)	1
2. Classroom 1 & 6 (Flr 1 & 2)......	(SZ CAV)	4
3. Classroom 2 & 3 (Flr 1 & 2)......	(SZ CAV)	4
4. Classroom 4 (Flr 1 & 2)..........	(SZ CAV)	2
5. Classroom 5 (Flr 1 & 2)..........	(SZ CAV)	2
6. Classrooms 1 & 6 (3rd Flr).......	(SZ CAV)	2
7. Classrooms 2 & 3 (3rd Flr).......	(SZ CAV)	2
8. Classroom 4 (3rd Flr)...........	(SZ CAV)	1
9. Classroom 5 (3rd Flr)...........	(SZ CAV)	1
10. Perimeter Fan Coil Units - Base..	(2P-FC)	1
12. Basement Classrooms (2)-Baseline.	(SZ CAV)	2

WATER-COOLED CENTRIFUGAL CHILLER DATA

Estimated maximum cooling load...:	381.7 Tons
Design ECWT......................:	85.0 F
Design LCHWT.....................:	44.0 F
Chiller capacity at design.......:	305.0 Tons
Chiller input power at design....:	0.700 kW/Ton
Is chilled water reset used......?	N
% load for chiller cutoff........:	20.0 %

PLANT INPUT DATA

PART-LOAD PERFORMANCE DATA

LCHWT = 44.0 F

% Load	% kW	ECWT (F)
100.0	100.0	85.0
90.0	85.0	82.5
80.0	72.0	80.0
70.0	61.0	77.5
60.0	51.0	75.0
50.0	43.0	72.5
40.0	37.0	70.0
30.0	31.0	67.5
20.0	26.0	65.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	10.0	51.00	70.0	85.0	11.82	5.0
Condenser Water	10.0	37.50	70.0	80.0	11.07	-

FREE COOLING DATA

Type of free cooling..................: Not Used

OPEN COOLING TOWER DATA

Design inlet water temperature.........: 95.0 F
Design outlet water temperature........: 85.0 F
Tower design airflow rate..............: 250.0 CFM/Ton
Tower fan power........................: 12.5 kW
Minimum outlet temperature.............: 60.0 F
Use fan cycling or water bypass........? Fan Cycling
Make-up water temperature..............: 55.0 F

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Heating Plant - Baseline
Classification..............: Heating
Type........................: Hot Water Boiler

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
1. Auditorium - Baseline...........	-	1	-	-
2. Classroom 1 & 6 (Flr 1 & 2)......	-	4	-	-
3. Classroom 2 & 3 (Flr 1 & 2)......	-	4	-	-
4. Classroom 4 (Flr 1 & 2)..........	-	2	-	-
5. Classroom 5 (Flr 1 & 2)..........	-	2	-	-
6. Classrooms 1 & 6 (3rd Flr).......	-	2	-	-
7. Classrooms 2 & 3 (3rd Flr).......	-	2	-	-
8. Classroom 4 (3rd Flr)............	-	1	-	-
9. Classroom 5 (3rd Flr)............	-	1	-	-
10. Perimeter Fan Coil Units - Base..	-	1	-	-
11. Stair Towers....................	-	1	-	-
12. Basement Classrooms (2)-Baseline.	-	2	-	-
15. Corridors.......................	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...: 3787.2 MBH
Gross output at design...........: 4474.0 MBH
Energy input at design...........: 6391.4 MBH
Overall efficiency at design.....: 70.0 %
Fuel or energy type..............: Nat. Gas
Combustion air blower kW.........: 0.000 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	70.0	40	60.0
80	70.0	30	60.0
70	70.0	20	60.0
60	70.0	10	60.0
50	70.0	0	0.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	20.0	75.00	70.0	80.0	11.28	0.0

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name.................:	Cooling Plant - PLC
Classification.............:	Cooling
Type.......................:	Water-Cooled Chiller
Type of simulation model....:	Computer-Generated
Type of chiller............:	W/C Centrifugal
Type of heat rejection model:	Open Cooling Tower Model

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
2. Classroom 1 & 6 (Flr 1 & 2)......	(SZ CAV)	4
3. Classroom 2 & 3 (Flr 1 & 2)......	(SZ CAV)	4
4. Classroom 4 (Flr 1 & 2)..........	(SZ CAV)	2
5. Classroom 5 (Flr 1 & 2)..........	(SZ CAV)	2
6. Classrooms 1 & 6 (3rd Flr).......	(SZ CAV)	2
7. Classrooms 2 & 3 (3rd Flr).......	(SZ CAV)	2
8. Classroom 4 (3rd Flr)............	(SZ CAV)	1
9. Classroom 5 (3rd Flr)............	(SZ CAV)	1
13. Auditorium - PLC.................	(SZ CAV)	1
14. Perimeter Fan Coil Units - PLC...	(2P-FC)	1
16. Basement Classrooms (2) - PLC....	(SZ CAV)	2

WATER-COOLED CENTRIFUGAL CHILLER DATA

Estimated maximum cooling load...:	402.1 Tons
Design ECWT......................:	85.0 F
Design LCHWT.....................:	44.0 F
Chiller capacity at design.......:	305.0 Tons
Chiller input power at design....:	0.700 kW/Ton
Is chilled water reset used......?	N
% load for chiller cutoff........:	20.0 %

PLANT INPUT DATA

Plant: Cooling Plant - PLC — 01-06-95
Prepared By: EINHORN YAFFEE PRESCOTT —

PART-LOAD PERFORMANCE DATA

LCHWT = 44.0 F

% Load	% kW	ECWT (F)
100.0	100.0	85.0
90.0	85.0	82.5
80.0	72.0	80.0
70.0	61.0	77.5
60.0	51.0	75.0
50.0	43.0	72.5
40.0	37.0	70.0
30.0	31.0	67.5
20.0	26.0	65.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	10.0	51.00	70.0	85.0	11.82	5.0
Condenser Water	10.0	37.50	70.0	80.0	11.07	-

FREE COOLING DATA

Type of free cooling..................: Not Used

OPEN COOLING TOWER DATA

Design inlet water temperature.........: 95.0 F
Design outlet water temperature........: 85.0 F
Tower design airflow rate..............: 250.0 CFM/Ton
Tower fan power........................: 12.5 kW
Minimum outlet temperature.............: 60.0 F
Use fan cycling or water bypass........? Fan Cycling
Make-up water temperature..............: 55.0 F

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Heating Plant - PLC
Classification..............: Heating
Type........................: Hot Water Boiler

AIR SYSTEM SELECTIONS

	Heating Coil Category			
Air System Name	Pre-Heat	Central	Terminal	Zone
2. Classroom 1 & 6 (Flr 1 & 2)......	-	4	-	-
3. Classroom 2 & 3 (Flr 1 & 2)......	-	4	-	-
4. Classroom 4 (Flr 1 & 2)..........	-	2	-	-
5. Classroom 5 (Flr 1 & 2)..........	-	2	-	-
6. Classrooms 1 & 6 (3rd Flr).......	-	2	-	-
7. Classrooms 2 & 3 (3rd Flr).......	-	2	-	-
8. Classroom 4 (3rd Flr)............	-	1	-	-
9. Classroom 5 (3rd Flr)............	-	1	-	-
11. Stair Towers.....................	-	1	-	-
13. Auditorium - PLC.................	-	1	-	-
14. Perimeter Fan Coil Units - PLC...	-	1	-	-
15. Corridors........................	-	1	-	-
16. Basement Classrooms (2) - PLC....	-	2	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...: 3787.2 MBH
Gross output at design...........: 4474.0 MBH
Energy input at design...........: 6391.4 MBH
Overall efficiency at design.....: 70.0 %
Fuel or energy type..............: Nat. Gas
Combustion air blower kW.........: 0.000 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	70.0	40	60.0
80	70.0	30	60.0
70	70.0	20	60.0
60	70.0	10	60.0
50	70.0	0	0.0

****

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	20.0	75.00	70.0	80.0	11.28	5.0

PLANT INPUT DATA

Plant: Cooling Plant - DDC 01-06-95

Prepared By: EINHORN YAFFEE PRESCOTT Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name.................:	Cooling Plant - DDC
Classification.............:	Cooling
Type.......................:	Water-Cooled Chiller
Type of simulation model....:	Computer-Generated
Type of chiller............:	W/C Centrifugal
Type of heat rejection model:	Open Cooling Tower Model

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
2. Classroom 1 & 6 (Flr 1 & 2)......	(SZ CAV)	4
3. Classroom 2 & 3 (Flr 1 & 2)......	(SZ CAV)	4
4. Classroom 4 (Flr 1 & 2)..........	(SZ CAV)	2
5. Classroom 5 (Flr 1 & 2)..........	(SZ CAV)	2
6. Classrooms 1 & 6 (3rd Flr).......	(SZ CAV)	2
7. Classrooms 2 & 3 (3rd Flr).......	(SZ CAV)	2
8. Classroom 4 (3rd Flr)...........	(SZ CAV)	1
9. Classroom 5 (3rd Flr)...........	(SZ CAV)	1
17. Auditorium - DDC................	(SZ CAV)	1
18. Perimeter Fan Coil Units - DDC...	(2P-FC)	1
20. Basement Classrooms (2) - DDC....	(SZ CAV)	2

WATER-COOLED CENTRIFUGAL CHILLER DATA

Estimated maximum cooling load...:	402.5 Tons
Design ECWT......................:	85.0 F
Design LCHWT.....................:	44.0 F
Chiller capacity at design.......:	305.0 Tons
Chiller input power at design....:	0.700 kW/Ton
Is chilled water reset used......?	N
% load for chiller cutoff........:	20.0 %

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PLANT INPUT DATA

Plant: Cooling Plant - DDC 01-06-95

Prepared By: EINHORN YAFFEE PRESCOTT

****

PART-LOAD PERFORMANCE DATA

LCHWT = 44.0 F

% Load	% kW	ECWT (F)
100.0	100.0	85.0
90.0	85.0	82.5
80.0	72.0	80.0
70.0	61.0	77.5
60.0	51.0	75.0
50.0	43.0	72.5
40.0	37.0	70.0
30.0	31.0	67.5
20.0	26.0	65.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	10.0	51.00	70.0	85.0	11.82	5.0
Condenser Water	10.0	37.50	70.0	80.0	11.07	-

FREE COOLING DATA

Type of free cooling..................: Not Used

OPEN COOLING TOWER DATA

Design inlet water temperature.........: 95.0 F
Design outlet water temperature........: 85.0 F
Tower design airflow rate..............: 250.0 CFM/Ton
Tower fan power........................: 12.5 kW
Minimum outlet temperature.............: 60.0 F
Use fan cycling or water bypass........? Fan Cycling
Make-up water temperature..............: 55.0 F

PLANT INPUT DATA

Plant: Heating Plant - DDC 01-06-95

Prepared By: EINHORN YAFFEE PRESCOTT

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name	Heating Plant - DDC
Classification	Heating
Type	Hot Water Boiler

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
2. Classroom 1 & 6 (Flr 1 & 2)	-	4	-	-
3. Classroom 2 & 3 (Flr 1 & 2)	-	4	-	-
4. Classroom 4 (Flr 1 & 2)	-	2	-	-
5. Classroom 5 (Flr 1 & 2)	-	2	-	-
6. Classrooms 1 & 6 (3rd Flr)	-	2	-	-
7. Classrooms 2 & 3 (3rd Flr)	-	2	-	-
8. Classroom 4 (3rd Flr)	-	1	-	-
9. Classroom 5 (3rd Flr)	-	1	-	-
11. Stair Towers	-	1	-	-
15. Corridors	-	1	-	-
17. Auditorium - DDC	-	1	-	-
18. Perimeter Fan Coil Units - DDC	-	1	-	-
20. Basement Classrooms (2) - DDC	-	2	-	-

HOT WATER BOILER DATA

Estimated maximum heating load	3793.0 MBH
Gross output at design	4474.0 MBH
Energy input at design	6391.4 MBH
Overall efficiency at design	70.0 %
Fuel or energy type	Nat. Gas
Combustion air blower kW	0.000 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	70.0	40	60.0
80	70.0	30	60.0
70	70.0	20	60.0
60	70.0	10	60.0
50	70.0	0	0.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	20.0	75.00	70.0	80.0	11.28	5.0

BUILDING NAME.........: Building 247 - Baseline

PLANT SELECTION

Plant Name	Type	Quantity
1. Cooling Plant - Baseline.......	(W/C CHILLER)	1
2. Heating Plant - Baseline.......	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Virginia Power - Kwh Only
Average building power factor.: NA

FUEL RATES

Natural gas..................: Washington Gas Rate Schedule 2
Fuel oil.....................: None
Propane......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 4729.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04

****

BUILDING NAME..........: Building 247 - PLC

PLANT SELECTION

	Plant Name	Type	Quantity
5.	Cooling Plant - PLC...........	(W/C CHILLER)	1
6.	Heating Plant - PLC...........	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Virginia Power - Kwh Only
Average building power factor.: NA

FUEL RATES

Natural gas...................: Washington Gas Rate Schedule 2
Fuel oil......................: None
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 4729.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING NAME..........: Building 247 - DDC

PLANT SELECTION

	Plant Name	Type	Quantity
9.	Cooling Plant - DDC...........	(W/C CHILLER)	1
10.	Heating Plant - DDC...........	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate................: Virginia Power - Kwh Only
Average building power factor.: NA

FUEL RATES

Natural gas..................: Washington Gas Rate Schedule 2
Fuel oil.....................: None
Propane......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 4729.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING 1425

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TABLE 1. SIMULATION WEATHER DATA DESIGN PARAMETERS

City......................................	Washington
Location..................................	Dist. of Columbia
Type of Data..............................	Typical Meteorological Year
Latitude..................................	38.9 deg
Longitude.................................	77.0 deg
Elevation.................................	14.0 ft
* Average Ground Reflectivity...............	0.20
Local Time Zone (GMT +/- N hours).........	5.0 hours
* Daylight Savings Time Considered..........?	N

* = User-defined design parameters. All other values are fixed.

TABLE 2. DRY-BULB TEMPERATURE STATISTICS (F)

Month	Absolute Maximum	Average Maximum	Average	Average Minimum	Absolute Minimum
January	60.4	39.3	30.7	21.0	-1.9
February	62.1	42.8	33.1	22.9	7.5
March	75.5	53.9	43.3	32.4	17.1
April	85.5	65.7	55.0	44.3	31.2
May	91.9	73.3	63.5	53.8	40.5
June	93.5	80.8	70.0	58.8	48.8
July	91.0	84.9	75.9	66.5	55.8
August	96.8	85.1	74.3	64.5	49.6
September	91.6	79.3	69.3	60.0	46.5
October	84.7	67.5	56.8	46.7	23.4
November	75.7	56.4	46.6	35.7	17.3
December	59.0	42.7	36.9	30.9	20.5

TABLE 3. DAILY TOTAL SOLAR RADIATION STATISTICS

	[---- Daily Total Solar ---] (BTU/sqft)			[-- Daily Clearness Number --] (Dimensionless)		
Month	Maximum	Average	Minimum	Maximum	Average	Minimum
January	1043.4	609.1	137.7	0.648	0.430	0.107
February	1448.6	815.5	79.9	0.685	0.433	0.048
March	1861.2	1183.4	211.6	0.680	0.473	0.094
April	2371.0	1484.8	247.6	0.717	0.479	0.079
May	2579.4	1712.0	355.4	0.711	0.487	0.104
June	2551.8	1890.8	515.8	0.697	0.514	0.140
July	2398.3	1714.6	629.5	0.657	0.478	0.171
August	2378.9	1696.2	708.2	0.694	0.522	0.227
September	1943.6	1307.6	258.0	0.674	0.482	0.094
October	1546.1	977.2	92.6	0.656	0.469	0.045
November	1143.4	672.4	129.4	0.647	0.437	0.094
December	803.2	488.0	73.1	0.618	0.382	0.057

Notes: * All solar data is daily total flux on a horizontal surface.
* Clearness number is (Daily Total Solar)/(Extraterrestrial Solar)
Values between 0.70 and 0.80 represent clear conditions.

CALENDAR DATA

Prepared By: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

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Calendar Name: Sample Calendar	Day Type Assignments
January first is on: Friday	Monday = Weekday Tuesday = Weekday Wednesday = Weekday Thursday = Weekday Friday = Weekday Saturday = Saturday Sunday = Sunday Holiday = Sunday
Day Type Names Day Type 1 = Weekday Day Type 2 = Saturday Day Type 3 = Sunday	

Holidays

(No holidays specified)

SCHEDULE DATA

Prepared By: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

Schedule Name: People Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	0	0	0	0	0	0	0	50	75	100	100	100
Weekday	0	0	0	0	0	0	0	50	75	100	100	100
Saturday	0	0	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	0	0

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	50	25	0	0	0	0	0
Weekday	100	100	100	100	100	50	25	0	0	0	0	0
Saturday	0	0	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	0	0

Schedule Name: Lights Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	25	25	25	25	25	25	25	50	100	100	100	100
Weekday	25	25	25	25	25	25	25	50	100	100	100	100
Saturday	25	25	25	25	25	25	25	25	25	25	25	25
Sunday	25	25	25	25	25	25	25	25	25	25	25	25

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	75	50	25	25	25	25	25
Weekday	100	100	100	100	100	75	50	25	25	25	25	25
Saturday	25	25	25	25	25	25	25	25	25	25	25	25
Sunday	25	25	25	25	25	25	25	25	25	25	25	25

****

WALL TYPE 1: (CUSTOM WALL)

Description...........: Brick Cavity Wall
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
4-in (102 mm) LW concrete block	4.00	38.0	0.20	1.52	12.7
Airspace	2.00	0.0	0.00	0.91	0.0
4-in (102 mm) common brick	4.00	120.0	0.20	0.79	40.0
Outside surface resistance	-	-	-	0.33	-
Totals	10.00			4.24	52.7

Thickness: in   Density: lb/cuft   Weight: lb/sqft
R-value : (hr-sqft-F)/BTU   Specific Heat: BTU/lb/F

ROOF CONSTRUCTION TYPES

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

ROOF TYPE 1: (CUSTOM ROOF)

Description...........: Built-up Roof

Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
Acoustic Ceiling Tile	0.75	18.0	0.14	1.90	1.1
R-19 (RSI-3.3) batt insulation	6.00	0.5	0.20	19.23	0.3
4-in (102 mm) LW concrete	5.00	40.0	0.20	4.17	16.7
Built-up roofing	0.38	70.0	0.35	0.33	2.2
1/2-in (13 mm) vegetable board	1.00	18.0	0.31	2.60	1.5
Outside surface resistance	-	-	-	0.33	-
Totals	13.13			29.25	21.7

Thickness: in Density: lb/cuft Weight: lb/sqft

R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

WINDOW TYPE 1: (PRE-DEFINED WINDOW)

Glass Group............: DOUBLE PANE, CLEAR
Glass Type.............: 1/8" clear + 1/8" clear
Window Description.....: Double Hung Double Pane Window
Height.................: 1.00 ft
Width..................: 1.00 ft
Frame Type.............: Aluminum with thermal breaks
Interior Shade Type....: No Shades Used
Overall U-value........: 0.632 BTU/hr/sqft/F
Overall Shade Coeff....: 0.850

Predefined Glass Data

Glass Transmissivity	Glass Reflectivity	Glass Absorptivity	Glass U-Value	Shade Coefficient
0.712	0.134	0.154	0.490	0.890

ELECTRIC RATE DATA

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

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BASIC ELECTRIC RATE INFORMATION

ELECTRIC RATE INFORMATION:	Rate schedule name......:	Ft. Belvoir Equivalent $/kWh
	Currency symbol...................:	$
	Type of rate schedule...............:	Simple
	Flat rate...........................:	0.01968 $/kWh

****

BASIC FUEL RATE INFORMATION

FUEL RATE INFORMATION:	Rate schedule name.......:	Ft. Belvoir District Steam
	Currency symbol..............:	$
	Units of measurement.........:	1000 lb
	Fuel conversion factor.......:	1000.00000 kBTU/1000 lb
	Type of rate schedule........:	Simple
	Flat rate....................:	7.98000 $/1000 lb

FUEL RATE DATA

****

BASIC FUEL RATE INFORMATION

FUEL RATE INFORMATION:	Rate schedule name.......:	Washington Gas Rate Schedule 2
	Currency symbol..............:	$
	Units of measurement.........:	Therm
	Fuel conversion factor.......:	100.00000 kBTU/Therm
	Type of rate schedule........:	Simple
	Flat rate....................:	0.60790 $/Therm

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT

HAP v3.04

****

GENERAL
- Name......: First Floor - South
- Floor Area......: 1476.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2.30 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 150.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 430.0 ft
- Slab Floor Area........: 1476.0 sqft
- Floor R-Value.........: 2.40
- Insulation R-value....: 0.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	960.0	1	1	291	-	1	0	-	N
E	180.0	1	1	45	-	1	0	-	N
W	180.0	1	1	45	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

C-268

SPACE DESCRIPTION

****

GENERAL
- Name......: First Floor - North
- Floor Area......: 936.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2.30 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 150.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 70.0 ft
- Slab Floor Area.......: 936.0 sqft
- Floor R-Value.........: 2.40
- Insulation R-value....: 0.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	520.0	1	1	180	-	1	0	-	N
W	180.0	1	1	45	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

C-269

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
Name......: First Floor - West
Floor Area......: 1368.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 2.30 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 150.0 sqft/per
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 2.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter............: 88.0 ft
Slab Floor Area.......: 1368.0 sqft
Floor R-Value.........: 2.40
Insulation R-value....: 0.00

===

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	760.0	1	1	200	-	1	0	-	N
W	120.0	1	1	45	-	1	0	-	N

===

No roof or door data for this space.

===

No partition data for this space.

===

C-270

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: First Floor - East
- Floor Area......: 1836.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2.30 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 150.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 116.0 ft
- Slab Floor Area.......: 1836.0 sqft
- Floor R-Value.........: 2.40
- Insulation R-value....: 0.00

==

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	200.0	1	1	45	-	1	0	-	N
E	1020.0	1	1	270	-	1	0	-	N

==

No roof or door data for this space.

==

No partition data for this space.

==

C-271

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: 1st Floor Corr. & Lobby
- Floor Area......: 1266.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.0 CFM
- Heating.....: 0.0 CFM
- Typical.....: 0.0 CFM
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter............: 0.0 ft
- Slab Floor Area.......: 1266.0 sqft
- Floor R-Value.........: 2.40
- Insulation R-value....: 0.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	120.0	1	1	40	-	1	0	-	N
S	140.0	1	1	40	-	1	0	-	N
W	50.0	1	1	0	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

C-272

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

GENERAL
- Name......: Second Floor - South
- Floor Area......: 1566.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2.30 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 150.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	870.0	1	1	290	-	1	0	-	N
W	180.0	1	1	45	-	1	0	-	N
E	180.0	1	1	45	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1566.0	1	1	0

No partition data for this space.

C-273

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

GENERAL
- Name......: Second Floor - North
- Floor Area......: 936.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2.30 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 150.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	520.0	1	1	180	-	1	0	-	N
W	180.0	1	1	45	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	936.0	1	1	0

No partition data for this space.

C-274

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL

Name......: Second Floor - West
Floor Area.......: 1368.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING

Overhead Fixture: Recessed
Lamp Wattage....: 2.30 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE

Occupancy.......: 150.0 sqft/per
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS

Equipment.......: 2.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES

Lighting....: Lights
Task Lights.: Lights
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION

Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR

Type........:Above Conditioned Space

==

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	760.0	1	1	200	-	1	0	-	N
W	120.0	1	1	45	-	1	0	-	N

==

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1368.0	1	1	0

==

No partition data for this space.

==

C-275

SPACE DESCRIPTION

****

GENERAL
Name......: Second Floor - East
Floor Area......: 1950.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 2.30 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 150.0 sqft/per
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 2.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	260.0	1	1	65	-	1	0	-	N
E	1020.0	1	1	270	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1950.0	1	1	0

No partition data for this space.

C-276

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

GENERAL
- Name......: 2nd Floor Corr. & Stairs
- Floor Area.......: 1034.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	50.0	1	1	0	-	1	0	-	N
S	80.0	1	1	0	-	1	0	-	N
W	50.0	1	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1034.0	1	1	0

No partition data for this space.

C-277

AIR SYSTEM INPUT DATA

****

1. SYSTEM NAME AND TYPE

Name............:	Fan Coil Units - NO EMS
Type............:	TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.:	8

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Supply Air....................:	55.0 F
Fan Cycled for Cooling........?	N
Coil Bypass Factor............:	0.100
HEATING SYSTEM DATA	
Fan Cycled for Heating........?	N
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	0.15 CFM/sqft

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Terminal Type............:	Fan Coil	
Fan Total Static....(in.wg.):	0.25	
Fan Efficiency...........(%):	54	

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - NO EMS 01-04-95
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? Y

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Convectors - Baseline 12-30-94
Type: TERMINAL UNITS - Convective Htg and Clg HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SYSTEM NAME AND TYPE

Name............: Convectors - Baseline
Type............: TERMINAL UNITS - Convective Htg and Clg
Number of Zones.: 2

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Is Cooling System Used........? N
HEATING SYSTEM DATA
Is Heating System Used........? Y
OUTDOOR VENTILATION DATA
Common Ventilation System Used? N
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %

3. ZONE DATA

ZONE	1 (All Zones the Same)
T-Stat Zone Setpoint.......(F):	70.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - PLC 01-04-95
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SYSTEM NAME AND TYPE

```
Name............: Fan Coil Units - PLC
Type............: TERMINAL UNITS  - 2-Pipe Fan Coils
Number of Zones.:  8
```

2. SYSTEM DESCRIPTION

```
COOLING SYSTEM DATA
 Supply Air....................:           55.0 F
 Fan Cycled for Cooling........?              N
 Coil Bypass Factor............:          0.100
HEATING SYSTEM DATA
 Fan Cycled for Heating........?              N
OUTDOOR VENTILATION DATA
 Common Ventilation System Used?              N
SAFETY FACTORS
 Sensible Cooling Factor.......:              0 %
 Latent Cooling Factor.........:              0 %
 Heating Factor................:              0 %
OUTDOOR VENTILATION DATA
 Type of Control...............:     Constant Airflow Rate
 Design Ventilation Airflow....:           0.15 CFM/sqft
```

3. ZONE DATA

```
ZONE                                          1   (All Zones the Same)
T-Stat Occupied Cooling....(F):            75.0
       Unoccupied Cooling..(F):            85.0
       Occupied Heating....(F):            70.0
       Unoccupied Heating..(F):            55.0
       Throttling Range....(F):             3.0
Zone Terminal Type............:        Fan Coil
  Fan Total Static....(in.wg.):            0.25
  Fan Efficiency..........(%):               54
```

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AIR SYSTEM INPUT DATA

Name: Fan Coil Units - PLC 01-04-95
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 2

****

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............								X	X	X	X	X	X	X	X	X	X	X	X					
Weekday...............								X	X	X	X	X	X	X	X	X	X	X	X					
Saturday..............																								
Sunday................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Convectors - PLC 12-30-94
Type: TERMINAL UNITS - Convective Htg and Clg HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SYSTEM NAME AND TYPE

Name............: Convectors - PLC
Type............: TERMINAL UNITS - Convective Htg and Clg
Number of Zones.: 2

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Is Cooling System Used........? N
HEATING SYSTEM DATA
Is Heating System Used........? Y
OUTDOOR VENTILATION DATA
Common Ventilation System Used? N
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %

3. ZONE DATA

ZONE 1 (All Zones the Same)
T-Stat Zone Setpoint.......(F): 70.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday.................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - DDC 01-04-95
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Fan Coil Units - DDC
Type............: TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.: 8

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Supply Air....................: 55.0 F
Fan Cycled for Cooling........? N
Coil Bypass Factor............: 0.100
HEATING SYSTEM DATA
Fan Cycled for Heating........? N
OUTDOOR VENTILATION DATA
Common Ventilation System Used? N
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %
OUTDOOR VENTILATION DATA
Type of Control...............: Constant Airflow Rate
Design Ventilation Airflow....: 0.15 CFM/sqft

==

3. ZONE DATA

ZONE 1 (All Zones the Same)
T-Stat Occupied Cooling....(F): 75.0
Unoccupied Cooling..(F): 85.0
Occupied Heating....(F): 70.0
Unoccupied Heating..(F): 55.0
Throttling Range....(F): 3.0
Zone Terminal Type............: Fan Coil
Fan Total Static....(in.wg.): 0.25
Fan Efficiency...........(%): 54

==

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AIR SYSTEM INPUT DATA

Name: Fan Coil Units - DDC 01-04-95
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............								X	X	X	X	X	X	X	X	X	X	X	X					
Weekday................								X	X	X	X	X	X	X	X	X	X	X	X					
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Convectors - DDC 12-30-94
Type: TERMINAL UNITS - Convective Htg and Clg HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SYSTEM NAME AND TYPE

Name............: Convectors - DDC
Type............: TERMINAL UNITS - Convective Htg and Clg
Number of Zones.: 2

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Cooling System Used........?	N
HEATING SYSTEM DATA	
Is Heating System Used........?	Y
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Zone Setpoint.......(F):	70.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday.................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX

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AIR SYSTEM INPUT DATA

Name: Fan Coil Units - NO EMS 12-30-94
Type: TERMINAL UNITS - 4-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. First Floor - South	1		
SPACES IN ZONE 2 (Zone 2)			
2. First Floor - North	1		
SPACES IN ZONE 3 (Zone 3)			
3. First Floor - West	1		
SPACES IN ZONE 4 (Zone 4)			
4. First Floor - East	1		
SPACES IN ZONE 5 (Zone 5)			
6. Second Floor - South	1		
SPACES IN ZONE 6 (Zone 6)			
7. Second Floor - North	1		
SPACES IN ZONE 7 (Zone 7)			
8. Second Floor - West	1		
SPACES IN ZONE 8 (Zone 8)			
9. Second Floor - East	1		

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - Baseline 12-30-94
Type: TERMINAL UNITS - 4-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. First Floor - South	1		
SPACES IN ZONE 2 (Zone 2)			
2. First Floor - North	1		
SPACES IN ZONE 3 (Zone 3)			
3. First Floor - West	1		
SPACES IN ZONE 4 (Zone 4)			
4. First Floor - East	1		
SPACES IN ZONE 5 (Zone 5)			
6. Second Floor - South	1		
SPACES IN ZONE 6 (Zone 6)			
7. Second Floor - North	1		
SPACES IN ZONE 7 (Zone 7)			
8. Second Floor - West	1		
SPACES IN ZONE 8 (Zone 8)			
9. Second Floor - East	1		

AIR SYSTEM INPUT DATA

Name: Convectors - Baseline 12-30-94
Type: TERMINAL UNITS - Convective Htg and Clg HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
5. 1st Floor Corr. & Lobby	1		
SPACES IN ZONE 2 (Zone 2)			
10. 2nd Floor Corr. & Stairs	1		

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - PLC 12-30-94
Type: TERMINAL UNITS - 4-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. First Floor - South	1		
SPACES IN ZONE 2 (Zone 2)			
2. First Floor - North	1		
SPACES IN ZONE 3 (Zone 3)			
3. First Floor - West	1		
SPACES IN ZONE 4 (Zone 4)			
4. First Floor - East	1		
SPACES IN ZONE 5 (Zone 5)			
6. Second Floor - South	1		
SPACES IN ZONE 6 (Zone 6)			
7. Second Floor - North	1		
SPACES IN ZONE 7 (Zone 7)			
8. Second Floor - West	1		
SPACES IN ZONE 8 (Zone 8)			
9. Second Floor - East	1		

AIR SYSTEM INPUT DATA

Name: Convectors - PLC | 12-30-94
Type: TERMINAL UNITS - Convective Htg and Clg | HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT | Page 1

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
5. 1st Floor Corr. & Lobby	1		
SPACES IN ZONE 2 (Zone 2)			
10. 2nd Floor Corr. & Stairs	1		

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AIR SYSTEM INPUT DATA

Name: Fan Coil Units - DDC 12-30-94
Type: TERMINAL UNITS - 4-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. First Floor - South	1		
SPACES IN ZONE 2 (Zone 2)			
2. First Floor - North	1		
SPACES IN ZONE 3 (Zone 3)			
3. First Floor - West	1		
SPACES IN ZONE 4 (Zone 4)			
4. First Floor - East	1		
SPACES IN ZONE 5 (Zone 5)			
6. Second Floor - South	1		
SPACES IN ZONE 6 (Zone 6)			
7. Second Floor - North	1		
SPACES IN ZONE 7 (Zone 7)			
8. Second Floor - West	1		
SPACES IN ZONE 8 (Zone 8)			
9. Second Floor - East	1		

AIR SYSTEM INPUT DATA

Name: Convectors - DDC 12-30-94
Type: TERMINAL UNITS - Convective Htg and Clg HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
5. 1st Floor Corr. & Lobby	1		
SPACES IN ZONE 2 (Zone 2)			
10. 2nd Floor Corr. & Stairs	1		

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PLANT INPUT DATA

Plant: Cooling Plant - NO EMS — 12-30-94

Prepared By: EINHORN YAFFEE PRESCOTT — Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Cooling Plant - NO EMS
Classification..............: Cooling
Type........................: Air-Cooled Chiller
Type of simulation model....: Computer-Generated
Type of chiller.............: A/C Reciprocating

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
1. Fan Coil Units - NO EMS..........	(4P-FC)	1

AIR-COOLED RECIPROCATING CHILLER DATA

Estimated maximum cooling load...: NA
Chiller capacity at design.......: 40.0 Tons
Chiller input power at design....: 1.125 kW/Ton
Chiller configuration............: Mult. Compressors / Ckt., Unloaded
Is chilled water reset used......? N
Is hot gas bypass used...........? N
% load for minimum unloading.....: 20.0 %
Crankcase heater kW..............: 0.000 kW

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	6.0	75.00	70.0	81.0	3.96	0.0

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Heating Plant - NO EMS
Classification..............: Heating
Type........................: Remote Source Heating

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
1. Fan Coil Units - NO EMS..........	-	1	-	-
3. Convectors - Baseline............	-	1	-	-

REMOTE SOURCE HEATING DATA

Estimated maximum heating load...: NA
Gross heating capacity...........: 1052.0 MBH

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	16.7	95.00	70.0	81.0	3.97	5.0

PLANT INPUT DATA

Plant: Cooling Plant - PLC 12-30-94
Prepared By: EINHORN YAFFEE PRESCOTT Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	Cooling Plant - PLC
Classification..............:	Cooling
Type........................:	Air-Cooled Chiller
Type of simulation model....:	Computer-Generated
Type of chiller.............:	A/C Reciprocating

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
4. Fan Coil Units - PLC.............	(4P-FC)	1

AIR-COOLED RECIPROCATING CHILLER DATA

Estimated maximum cooling load...:	37.0 Tons
Chiller capacity at design.......:	40.0 Tons
Chiller input power at design....:	1.125 kW/Ton
Chiller configuration............:	Mult. Compressors / Ckt., Unloaded
Is chilled water reset used......?	N
Is hot gas bypass used...........?	N
% load for minimum unloading.....:	20.0 %
Crankcase heater kW..............:	0.000 kW

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	6.0	75.00	70.0	81.0	3.96	0.0

PLANT INPUT DATA

PLANT NAME, CLASSIFICATION & TYPE

Plant name	Heating Plant - PLC
Classification	Heating
Type	Remote Source Heating

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
4. Fan Coil Units - PLC	-	1	-	-
5. Convectors - PLC	-	1	-	-

REMOTE SOURCE HEATING DATA

Estimated maximum heating load	282.1 MBH
Gross heating capacity	1052.0 MBH

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	16.7	95.00	70.0	81.0	3.98	0.0

PLANT INPUT DATA

Plant: Cooling Plant - DDC 12-30-94
Prepared By: EINHORN YAFFEE PRESCOTT Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name.................:	Cooling Plant - DDC
Classification.............:	Cooling
Type.......................:	Air-Cooled Chiller
Type of simulation model....:	Computer-Generated
Type of chiller.............:	A/C Reciprocating

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
6. Fan Coil Units - DDC.............	(4P-FC)	1

AIR-COOLED RECIPROCATING CHILLER DATA

Estimated maximum cooling load...:	37.0 Tons
Chiller capacity at design.......:	40.0 Tons
Chiller input power at design....:	1.125 kW/Ton
Chiller configuration............:	Mult. Compressors / Ckt., Unloaded
Is chilled water reset used......?	N
Is hot gas bypass used...........?	N
% load for minimum unloading.....:	20.0 %
Crankcase heater kW..............:	0.000 kW

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	6.0	75.00	70.0	81.0	3.96	0.0

PLANT INPUT DATA

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name	Heating Plant - DDC
Classification	Heating
Type	Remote Source Heating

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
6. Fan Coil Units - DDC	-	1	-	-
7. Convectors - DDC	-	1	-	-

REMOTE SOURCE HEATING DATA

Estimated maximum heating load	282.1 MBH
Gross heating capacity	1052.0 MBH

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	16.7	95.00	70.0	81.0	3.98	0.0

BUILDING INPUT DATA

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04 Page 1

****

BUILDING NAME..........: Building 1425 - NO EMS

PLANT SELECTION

Plant Name	Type	Quantity
1. Cooling Plant - NO EMS.........	(A/C CHILLER)	1
2. Heating Plant - NO EMS.........	(REMOTE HTG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Ft. Belvoir Equivalent $/kWh
Average building power factor.: NA

FUEL RATES

Natural gas..................: None
Fuel oil.....................: None
Propane......................: None
Remote source heating.........: Ft. Belvoir District Steam
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 1694.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04

****

BUILDING NAME..........: Building 1425 - PLC

PLANT SELECTION

Plant Name	Type	Quantity
5. Cooling Plant - PLC...........	(A/C CHILLER)	1
6. Heating Plant - PLC...........	(REMOTE HTG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Ft. Belvoir Equivalent $/kWh
Average building power factor.: NA

FUEL RATES

Natural gas..................: None
Fuel oil.....................: None
Propane......................: None
Remote source heating.........: Ft. Belvoir District Steam
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 1694.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04 Page 1

BUILDING NAME..........: Building 1425 - DDC

PLANT SELECTION

Plant Name	Type	Quantity
7. Cooling Plant - DDC............	(A/C CHILLER)	1
8. Heating Plant - DDC............	(REMOTE HTG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Ft. Belvoir Equivalent $/kWh
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: None
Propane.......................: None
Remote source heating.........: Ft. Belvoir District Steam
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 1694.0 sqft
Source electric generating efficiency............: 100.00 %

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BUILDING 3136

SIMULATION WEATHER DATA SUMMARY

Data: Washington, Dist. of Columbia (TMY) 12-30-94

HAP v3.04

****

TABLE 1. SIMULATION WEATHER DATA DESIGN PARAMETERS

City	Washington
Location	Dist. of Columbia
Type of Data	Typical Meteorological Year
Latitude	38.9 deg
Longitude	77.0 deg
Elevation	14.0 ft
* Average Ground Reflectivity	0.20
Local Time Zone (GMT +/- N hours)	5.0 hours
* Daylight Savings Time Considered?	N

* = User-defined design parameters. All other values are fixed.

TABLE 2. DRY-BULB TEMPERATURE STATISTICS (F)

Month	Absolute Maximum	Average Maximum	Average	Average Minimum	Absolute Minimum
January	60.4	39.3	30.7	21.0	-1.9
February	62.1	42.8	33.1	22.9	7.5
March	75.5	53.9	43.3	32.4	17.1
April	85.5	65.7	55.0	44.3	31.2
May	91.9	73.3	63.5	53.8	40.5
June	93.5	80.8	70.0	58.8	48.8
July	91.0	84.9	75.9	66.5	55.8
August	96.8	85.1	74.3	64.5	49.6
September	91.6	79.3	69.3	60.0	46.5
October	84.7	67.5	56.8	46.7	23.4
November	75.7	56.4	46.6	35.7	17.3
December	59.0	42.7	36.9	30.9	20.5

TABLE 3. DAILY TOTAL SOLAR RADIATION STATISTICS

	[---- Daily Total Solar ---] (BTU/sqft)			[-- Daily Clearness Number --] (Dimensionless)		
Month	Maximum	Average	Minimum	Maximum	Average	Minimum
January	1043.4	609.1	137.7	0.648	0.430	0.107
February	1448.6	815.5	79.9	0.685	0.433	0.048
March	1861.2	1183.4	211.6	0.680	0.473	0.094
April	2371.0	1484.8	247.6	0.717	0.479	0.079
May	2579.4	1712.0	355.4	0.711	0.487	0.104
June	2551.8	1890.8	515.8	0.697	0.514	0.140
July	2398.3	1714.6	629.5	0.657	0.478	0.171
August	2378.9	1696.2	708.2	0.694	0.522	0.227
September	1943.6	1307.6	258.0	0.674	0.482	0.094
October	1546.1	977.2	92.6	0.656	0.469	0.045
November	1143.4	672.4	129.4	0.647	0.437	0.094
December	803.2	488.0	73.1	0.618	0.382	0.057

Notes: * All solar data is daily total flux on a horizontal surface.
* Clearness number is (Daily Total Solar)/(Extraterrestrial Solar) Values between 0.70 and 0.80 represent clear conditions.

Calendar Name: Sample Calendar	Day Type Assignments
January first is on: Friday	Monday = Weekday Tuesday = Weekday Wednesday = Weekday
Day Type Names Day Type 1 = Weekday Day Type 2 = Saturday Day Type 3 = Sunday	Thursday = Weekday Friday = Weekday Saturday = Saturday Sunday = Sunday Holiday = Sunday

Holidays

(No holidays specified)

SCHEDULE DATA

Prepared By: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04

Schedule Name: People Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	0	0	0	0	0	0	0	50	75	100	100	100
Weekday	0	0	0	0	0	0	0	50	75	100	100	100
Saturday	0	0	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	0	0

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	50	25	0	0	0	0	0
Weekday	100	100	100	100	100	50	25	0	0	0	0	0
Saturday	0	0	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	0	0

Schedule Name: People 24 Hrs. Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	100	100	100	100	100	100	100	100	100	100	100	100
Weekday	100	100	100	100	100	100	100	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	100	100	100	100	100	100	100
Weekday	100	100	100	100	100	100	100	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100

Schedule Name: Lights Hourly Percentages

Hour ----->	00	01	02	03	04	05	06	07	08	09	10	11
DESIGN DAY	25	25	25	25	25	25	25	25	50	100	100	100
Weekday	25	25	25	25	25	25	25	25	50	100	100	100
Saturday	25	25	25	25	25	25	25	25	25	25	25	25
Sunday	25	25	25	25	25	25	25	25	25	25	25	25

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
DESIGN DAY	100	100	100	100	100	100	75	25	25	25	25	25
Weekday	100	100	100	100	100	100	75	25	25	25	25	25
Saturday	25	25	25	25	25	25	25	25	25	25	25	25
Sunday	25	25	25	25	25	25	25	25	25	25	25	25

WALL TYPE 2: (CUSTOM WALL)

Description..........: Block Cavity Wall
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
4-in (102 mm) LW concrete block	4.00	38.0	0.20	1.52	12.7
Airspace	2.00	0.0	0.00	0.91	0.0
4-in (102 mm) LW concrete block	4.00	38.0	0.20	1.52	12.7
Outside surface resistance	-	-	-	0.33	-
Totals	10.00			4.96	25.3

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

ROOF TYPE 1: (CUSTOM ROOF)

Description..........: Built-up Roof
Absorptivity.........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
Built-up roofing	0.38	70.0	0.35	0.33	2.2
2-1/2" Poured Gypsum	2.50	40.0	0.20	2.08	8.3
1-in (13 mm) vegetable board	1.00	18.0	0.31	2.60	1.5
R-11 (RSI-1.9) batt insulation	3.50	0.5	0.20	11.22	0.1
3/4-in (13 mm) acoustic tile	0.75	18.0	0.14	2.50	1.1
Outside surface resistance	-	-	-	0.33	-
Totals	8.13			19.76	13.3

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

WINDOW TYPE 1: (PRE-DEFINED WINDOW)

Glass Group............: SINGLE PANE, CLEAR
Glass Type.............: 1/8" clear
Window Description.....: Single Pane, Clear
Height.................: 1.00 ft
Width..................: 1.00 ft
Frame Type.............: Aluminum with thermal breaks
Interior Shade Type....: No Shades Used
Overall U-value........: 1.094 BTU/hr/sqft/F
Overall Shade Coeff....: 0.903

Predefined Glass Data

Glass Transmissivity	Glass Reflectivity	Glass Absorptivity	Glass U-Value	Shade Coefficient
0.841	0.078	0.081	1.110	1.000

ELECTRIC RATE DATA

****

BASIC ELECTRIC RATE INFORMATION

ELECTRIC RATE INFORMATION:	Rate schedule name......:	Ft. Belvoir Equivalent $/kWh
	Currency symbol....................:	$
	Type of rate schedule...............:	Simple
	Flat rate...........................:	0.01968 $/kWh

FUEL RATE DATA

****

BASIC FUEL RATE INFORMATION

FUEL RATE INFORMATION:	Rate schedule name.......:	Ft. Belvoir District Steam
	Currency symbol..............:	$
	Units of measurement.........:	1000 lb
	Fuel conversion factor.......:	1000.00000 kBTU/1000 lb
	Type of rate schedule........:	Simple
	Flat rate....................:	7.98000 $/1000 lb

BASIC FUEL RATE INFORMATION

FUEL RATE INFORMATION:	Rate schedule name.......:	Washington Gas Rate Schedule 2
	Currency symbol..............:	$
	Units of measurement.........:	Therm
	Fuel conversion factor.......:	100.00000 kBTU/Therm
	Type of rate schedule........:	Simple
	Flat rate....................:	0.60790 $/Therm

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

GENERAL
- Name......: First Floor - North
- Floor Area......: 2650.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 150.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: People 24 Hrs.
- Task Lights.: People 24 Hrs.
- People......: People 24 Hrs.
- Equipment...: People 24 Hrs.
- Misc. Sens..: People 24 Hrs.
- Misc. Latent: People 24 Hrs.

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Unconditioned Space
- Floor Area............: 2650.0 sqft
- U-value...............: 0.420
- Max Space Temp........: 95.0 F
- Ambient Temp @ Max....: 95.0 F
- Min Space Temp........: 0.0 F
- Ambient Temp @ Minimum: 0.0 F

==

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
NW	275.0	2	1	0	-	1	0	-	N
SE	275.0	2	1	0	-	1	0	-	N
NE	980.0	2	1	623	-	1	0	-	N

==

No roof or door data for this space.

==

No partition data for this space.

==

C-312

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

GENERAL
Name......: First Floor - South
Floor Area......: 2650.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 3.00 W/sqft
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 150.0 sqft/per
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 2.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: People
Equipment...: People
Misc. Sens..: People
Misc. Latent: People

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Above Unconditioned Space
Floor Area............: 2650.0 sqft
U-value...............: 0.420
Max Space Temp........: 95.0 F
Ambient Temp @ Max....: 95.0 F
Min Space Temp........: 0.0 F
Ambient Temp @ Minimum: 0.0 F

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
SW	980.0	2	1	623	-	1	0	-	N
NW	275.0	2	1	0	-	1	0	-	N
SE	275.0	2	1	0	-	1	0	-	N

No roof or door data for this space.

No partition data for this space.

C-313

SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT 12-30-94

HAP v3.04 Page 1

****

```
GENERAL                                      SCHEDULES
 Name......: Second Floor - North             Lighting....: Lights
 Floor Area......:    2650.0 sqft             Task Lights.: Lights
 Building Weight.:      70.0 lb/sqft          People......: People
 Windows Shaded..?         N                  Equipment...: People
 Partitions Used.?         N                  Misc. Sens..: People
LIGHTING                                      Misc. Latent: People
 Overhead Fixture: Recessed                  INFILTRATION
 Lamp Wattage....:      3.00 W/sqft           Cooling.....:        0.00 CFM/sqft
 Ballast Mult....:      1.00                  Heating.....:        0.00 CFM/sqft
 Task Lighting...:      0.00 W/sqft           Typical.....:        0.00 CFM/sqft
PEOPLE                                        When Fan On.?           N
 Occupancy.......:     150.0 sqft/per        FLOOR
 Activity Level..: Office Work                Type........:Above Conditioned Space
 Sensible........:     245.0 BTU/hr
 Latent..........:     205.0 BTU/hr
OTHER LOADS
 Equipment.......:      2.00 W/sqft
 Misc. Sensible..:       0.0 BTU/hr
 Misc. Latent....:       0.0 BTU/hr
```

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
NW	275.0	2	1	0	-	1	0	-	N
NE	998.0	2	1	623	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	2650.0	1	1	0

No partition data for this space.

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SPACE DESCRIPTION

Prepared by: EINHORN YAFFEE PRESCOTT — 12-30-94

HAP v3.04 — Page 1

GENERAL
- Name......: Second Floor - South
- Floor Area......: 2650.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 3.00 W/sqft
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 150.0 sqft/per
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 2.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: People
- Misc. Latent: People

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
SW	980.0	2	1	623	-	1	0	-	N
NW	275.0	2	1	0	-	1	0	-	N
SE	275.0	2	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	2650.0	1	1	0

No partition data for this space.

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - Baseline	01-04-95
Type: TERMINAL UNITS - 2-Pipe Fan Coils	HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT	Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Fan Coil Units - Baseline
Type............: TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.: 4

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Supply Air...................:	55.0 F
Fan Cycled for Cooling........?	N
Coil Bypass Factor...........:	0.100
HEATING SYSTEM DATA	
Fan Cycled for Heating........?	N
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	0.15 CFM/sqft

==

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Terminal Type............:	Fan Coil	
Fan Total Static....(in.wg.):	0.25	
Fan Efficiency...........(%):	54	

==

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - Baseline 01-04-95
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? Y

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

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AIR SYSTEM INPUT DATA

****

1. SYSTEM NAME AND TYPE

Name............:	Fan Coil Units - PLC
Type............:	TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.:	3

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Supply Air....................:	55.0 F
Fan Cycled for Cooling........?	N
Coil Bypass Factor............:	0.100
HEATING SYSTEM DATA	
Fan Cycled for Heating........?	N
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	0.15 CFM/sqft

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Terminal Type............:	Fan Coil	
Fan Total Static....(in.wg.):	0.25	
Fan Efficiency..........(%):	54	

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - PLC　　12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils　　HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT　　

****

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X					
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X					
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ?　N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Fan Coil Units (1 North) - PLC   12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils   HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT   Page 1

****

1. SYSTEM NAME AND TYPE

Name............: Fan Coil Units (1 North) - PLC
Type............: TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.: 1

===

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Supply Air....................: 55.0 F
Fan Cycled for Cooling........? N
Coil Bypass Factor............: 0.100
HEATING SYSTEM DATA
Fan Cycled for Heating........? N
OUTDOOR VENTILATION DATA
Common Ventilation System Used? N
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %
OUTDOOR VENTILATION DATA
Type of Control...............: Constant Airflow Rate
Design Ventilation Airflow....: 0.15 CFM/sqft

===

3. ZONE DATA

ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0
Unoccupied Cooling..(F):	85.0
Occupied Heating....(F):	70.0
Unoccupied Heating..(F):	55.0
Throttling Range....(F):	3.0
Zone Terminal Type............:	Fan Coil
Fan Total Static....(in.wg.):	0.25
Fan Efficiency..........(%):	54

===

C-320

AIR SYSTEM INPUT DATA

Name: Fan Coil Units (1 North) - PLC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 2

****

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday.................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

C-321

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - DDC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

1. SYSTEM NAME AND TYPE

Name............: Fan Coil Units - DDC
Type............: TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.: 3

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Supply Air....................:	55.0 F
Fan Cycled for Cooling........?	N
Coil Bypass Factor............:	0.100
HEATING SYSTEM DATA	
Fan Cycled for Heating........?	N
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	0.15 CFM/sqft

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Terminal Type...........:	Fan Coil	
Fan Total Static....(in.wg.):	0.25	
Fan Efficiency..........(%):	54	

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - DDC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X					
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X					
Saturday...............																								
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

1. SYSTEM NAME AND TYPE

Name............: Fan Coil Units (1 North) - DDC
Type............: TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.: 1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Supply Air....................:	55.0 F
Fan Cycled for Cooling........?	N
Coil Bypass Factor............:	0.100
HEATING SYSTEM DATA	
Fan Cycled for Heating........?	N
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	0.15 CFM/sqft

3. ZONE DATA

ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0
Unoccupied Cooling..(F):	85.0
Occupied Heating....(F):	70.0
Unoccupied Heating..(F):	55.0
Throttling Range....(F):	3.0
Zone Terminal Type............:	Fan Coil
Fan Total Static....(in.wg.):	0.25
Fan Efficiency..........(%):	54

****

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday.................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX						XXX	XXX	XXX
Terminal Cooling.......					XXX	XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - Baseline 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. First Floor - North	1		
SPACES IN ZONE 2 (Zone 2)			
2. First Floor - South	1		
SPACES IN ZONE 3 (Zone 3)			
3. Second Floor - North	1		
SPACES IN ZONE 4 (Zone 4)			
4. Second Floor - South	1		

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - PLC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
2. First Floor - South	1		
SPACES IN ZONE 2 (Zone 2)			
3. Second Floor - North	1		
SPACES IN ZONE 3 (Zone 3)			
4. Second Floor - South	1		

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AIR SYSTEM INPUT DATA

Name: Fan Coil Units (1 North) - PLC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. First Floor - North	1		

AIR SYSTEM INPUT DATA

Name: Fan Coil Units - DDC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
2. First Floor - South	1		
SPACES IN ZONE 2 (Zone 2)			
3. Second Floor - North	1		
SPACES IN ZONE 3 (Zone 3)			
4. Second Floor - South	1		

AIR SYSTEM INPUT DATA

Name: Fan Coil Units (1 North) - DDC 12-30-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. First Floor - North	1		

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PLANT INPUT DATA

Plant: Cooling Plant - Baseline 12-30-94

Prepared By: EINHORN YAFFEE PRESCOTT Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	Cooling Plant - Baseline
Classification..............:	Cooling
Type........................:	Air-Cooled Chiller
Type of simulation model....:	Computer-Generated
Type of chiller.............:	A/C Reciprocating

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
1. Fan Coil Units - Baseline........	(2P-FC)	1

AIR-COOLED RECIPROCATING CHILLER DATA

Estimated maximum cooling load...:	NA
Chiller capacity at design.......:	40.0 Tons
Chiller input power at design....:	1.130 kW/Ton
Chiller configuration............:	Mult. Compressors / Ckt., Unloaded
Is chilled water reset used......?	N
Is hot gas bypass used...........?	N
% load for minimum unloading.....:	20.0 %
Crankcase heater kW..............:	0.000 kW

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	6.0	75.00	70.0	81.0	3.96	0.0

PLANT INPUT DATA

Plant: Heating Plant - Baseline 12-30-94

Prepared By: EINHORN YAFFEE PRESCOTT Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Heating Plant - Baseline
Classification..............: Heating
Type........................: Remote Source Heating

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
1. Fan Coil Units - Baseline........	-	1	-	-

REMOTE SOURCE HEATING DATA

Estimated maximum heating load...: NA
Gross heating capacity...........: 600.0 MBH

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	7.0	70.00	70.0	81.0	3.96	0.0

PLANT INPUT DATA

Plant: Cooling Plant - PLC 12-30-94

Prepared By: EINHORN YAFFEE PRESCOTT Page 1

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Cooling Plant - PLC
Classification..............: Cooling
Type........................: Air-Cooled Chiller
Type of simulation model....: Computer-Generated
Type of chiller.............: A/C Reciprocating

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
2. Fan Coil Units - PLC............	(2P-FC)	1
3. Fan Coil Units (1 North) - PLC...	(2P-FC)	1

AIR-COOLED RECIPROCATING CHILLER DATA

Estimated maximum cooling load...: NA
Chiller capacity at design.......: 40.0 Tons
Chiller input power at design....: 1.125 kW/Ton
Chiller configuration............: Mult. Compressors / Ckt., Unloaded
Is chilled water reset used......? N
Is hot gas bypass used...........? N
% load for minimum unloading.....: 20.0 %
Crankcase heater kW..............: 0.000 kW

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	6.0	75.00	70.0	81.0	3.96	0.0

PLANT INPUT DATA

Plant: Heating Plant - PLC 12-30-94
Prepared By: EINHORN YAFFEE PRESCOTT Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Heating Plant - PLC
Classification.............: Heating
Type........................: Remote Source Heating

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
2. Fan Coil Units - PLC............	-	1	-	-
3. Fan Coil Units (1 North) - PLC...	-	1	-	-

REMOTE SOURCE HEATING DATA

Estimated maximum heating load...: NA
Gross heating capacity...........: 600.0 MBH

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	7.0	70.00	70.0	81.0	3.96	0.0

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PLANT INPUT DATA

Plant: Cooling Plant - DDC 12-30-94

Prepared By: EINHORN YAFFEE PRESCOTT

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Cooling Plant - DDC
Classification..............: Cooling
Type........................: Air-Cooled Chiller
Type of simulation model....: Computer-Generated
Type of chiller.............: A/C Reciprocating

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
4. Fan Coil Units - DDC............	(2P-FC)	1
5. Fan Coil Units (1 North) - DDC...	(2P-FC)	1

AIR-COOLED RECIPROCATING CHILLER DATA

Estimated maximum cooling load...: NA
Chiller capacity at design.......: 40.0 Tons
Chiller input power at design....: 1.125 kW/Ton
Chiller configuration............: Mult. Compressors / Ckt., Unloaded
Is chilled water reset used......? N
Is hot gas bypass used...........? N
% load for minimum unloading.....: 20.0 %
Crankcase heater kW..............: 0.000 kW

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Chilled Water	6.0	75.00	70.0	81.0	3.96	0.0

PLANT INPUT DATA

Plant: Heating Plant - DDC 12-30-94

Prepared By: EINHORN YAFFEE PRESCOTT Page 1

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Heating Plant - DDC
Classification..............: Heating
Type........................: Remote Source Heating

AIR SYSTEM SELECTIONS

Air System Name	Pre-Heat	Central	Terminal	Zone
4. Fan Coil Units - DDC............	-	1	-	-
5. Fan Coil Units (1 North) - DDC...	-	1	-	-

Heating Coil Category applies to Pre-Heat, Central, Terminal, Zone.

REMOTE SOURCE HEATING DATA

Estimated maximum heating load...: NA
Gross heating capacity...........: 600.0 MBH

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	7.0	70.00	70.0	81.0	3.96	0.0

BUILDING NAME..........: Building 3136 - Baseline

PLANT SELECTION

	Plant Name	Type	Quantity
1.	Cooling Plant - Baseline.......	(A/C CHILLER)	1
2.	Heating Plant - Baseline.......	(REMOTE HTG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Ft. Belvoir Equivalent $/kWh
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: None
Propane.......................: None
Remote source heating.........: Ft. Belvoir District Steam
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 1160.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING NAME..........: Building 3136 - PLC

PLANT SELECTION

Plant Name	Type	Quantity
3. Cooling Plant - PLC...........	(A/C CHILLER)	1
4. Heating Plant - PLC...........	(REMOTE HTG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate................: Ft. Belvoir Equivalent $/kWh
Average building power factor.: NA

FUEL RATES

Natural gas..................: None
Fuel oil.....................: None
Propane......................: None
Remote source heating.........: Ft. Belvoir District Steam
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 1160.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: EINHORN YAFFEE PRESCOTT 01-06-95

HAP v3.04 Page 1

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BUILDING NAME..........: Building 3136 - DDC

PLANT SELECTION

Plant Name	Type	Quantity
5. Cooling Plant - DDC...........	(A/C CHILLER)	1
6. Heating Plant - DDC...........	(REMOTE HTG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Ft. Belvoir Equivalent $/kWh
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: None
Propane.......................: None
Remote source heating.........: Ft. Belvoir District Steam
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 1160.0 sqft
Source electric generating efficiency............: 100.00 %

APPENDIX D
CARRIER E20-II
BUILDING SIMULATION RESULTS

BUILDING 200

ANNUAL ENERGY COSTS

Building: Building 200 - Baseline 08-15-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	<---- Annual Costs -----> ($)	($/sqft)*	% of Total
Electric	291599 kWh	5739	0.219	18.3 %
Natural Gas	28480 Therm	17313	0.659	55.2 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		23052	0.878	73.5 %
Electric	421743 kWh	8300	0.316	26.5 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		8300	0.316	26.5 %
>>> GRAND TOTAL		31351	1.194	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area................: 26256 sqft
Conditioned floor area..........: 21402 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 200 - Baseline 08-15-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	1791881	68.247
Heating Loads	2583650	98.402

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	994935	37.894	994935	37.894
Natural Gas	2847986	108.470	2847986	108.470
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	3842922	146.364	3842922	146.364
Electric	1438987	54.806	1438987	54.806
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1438987	54.806	1438987	54.806
>>> GRAND TOTAL	5281909	201.170	5281909	201.170

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 26256 sqft
  Conditioned floor area..........: 21402 sqft

ANNUAL ENERGY COSTS

Building: Building 200 - PLC 08-15-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	<---- Annual Costs -----> ($)	($/sqft)*	% of Total
Electric	233536 kWh	4596	0.175	17.9 %
Natural Gas	21115 Therm	12836	0.489	49.9 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		17432	0.664	67.7 %
Electric	421743 kWh	8300	0.316	32.3 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		8300	0.316	32.3 %
>>> GRAND TOTAL		25732	0.980	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area................: 26256 sqft
Conditioned floor area..........: 21402 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 200 - PLC 08-15-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	1686259	64.224
Heating Loads	1662769	63.329

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	796826	30.348	796826	30.348
Natural Gas	2111492	80.419	2111492	80.419
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	2908318	110.768	2908318	110.768
Electric	1438987	54.806	1438987	54.806
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1438987	54.806	1438987	54.806
>>> GRAND TOTAL	4347305	165.574	4347305	165.574

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 26256 sqft
  Conditioned floor area..........: 21402 sqft

ANNUAL ENERGY COSTS

Building: Building 200 - DDC — 08-15-95
Weather: Washington (Washington TMY) — HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT —

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	<---- Annual Costs -----> ($)	($/sqft)*	% of Total
Electric	206634 kWh	4067	0.155	17.3 %
Natural Gas	18411 Therm	11192	0.426	47.5 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		15259	0.581	64.8 %
Electric	421743 kWh	8300	0.316	35.2 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		8300	0.316	35.2 %
>>> GRAND TOTAL		23559	0.897	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area...............: 26256 sqft
Conditioned floor area..........: 21402 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 200 - DDC — 08-15-95
Weather: Washington (Washington TMY) — HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT —

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	1349307	51.390
Heating Loads	1422854	54.192

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	705037	26.852	705037	26.852
Natural Gas	1841126	70.122	1841126	70.122
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	2546163	96.975	2546163	96.975
Electric	1438987	54.806	1438987	54.806
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1438987	54.806	1438987	54.806
>>> GRAND TOTAL	3985150	151.781	3985150	151.781

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 26256 sqft
  Conditioned floor area..........: 21402 sqft

BUILDING 219

ANNUAL ENERGY COSTS

Building: Building 219 - Baseline 12-30-94
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	388008 kWh	7636	0.232	23.9 %
Natural Gas	23850 Therm	14499	0.440	45.5 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		22135	0.672	69.4 %
Electric	496200 kWh	9765	0.296	30.6 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
>>> Non-HVAC Subtotal		9765	0.296	30.6 %
>>> GRAND TOTAL		31900	0.969	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area................: 32937 sqft
Conditioned floor area..........: 32937 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 219 - Baseline 12-30-94
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	1571199	47.703
Heating Loads	1338039	40.624

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	1323884	40.194	1323884	40.194
Natural Gas	2385029	72.412	2385029	72.412
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	3708913	112.606	3708913	112.606
Electric	1693033	51.402	1693033	51.402
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1693033	51.402	1693033	51.402
>>> GRAND TOTAL	5401945	164.008	5401945	164.008

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
Gross floor area................: 32937 sqft
Conditioned floor area..........: 32937 sqft

ANNUAL ENERGY COSTS

Building: Building 219 - PLC 12-30-94
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	<---- Annual Costs -----> ($)	($/sqft)*	% of Total
Electric	190811 kWh	3755	0.114	16.4 %
Natural Gas	15490 Therm	9417	0.286	41.1 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		13172	0.400	57.4 %
Electric	496200 kWh	9765	0.296	42.6 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
>>> Non-HVAC Subtotal		9765	0.296	42.6 %
>>> GRAND TOTAL		22937	0.696	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area...............: 32937 sqft
Conditioned floor area.........: 32937 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 219 - PLC 12-30-94
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	1261528	38.301
Heating Loads	794141	24.111

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	651047	19.766	651047	19.766
Natural Gas	1549035	47.030	1549035	47.030
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	2200082	66.797	2200082	66.797
Electric	1693033	51.402	1693033	51.402
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1693033	51.402	1693033	51.402
>>> GRAND TOTAL	3893114	118.199	3893114	118.199

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 32937 sqft
  Conditioned floor area..........: 32937 sqft

ANNUAL ENERGY COSTS

Building: Building 219 - DDC 12-30-94
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT
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TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	181447 kWh	3571	0.108	15.7 %
Natural Gas	15490 Therm	9417	0.286	41.4 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		12987	0.394	57.1 %
Electric	496200 kWh	9765	0.296	42.9 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
>>> Non-HVAC Subtotal		9765	0.296	42.9 %
>>> GRAND TOTAL		22753	0.691	100.0 %

* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 32937 sqft
  Conditioned floor area..........: 32937 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 219 - DDC 12-30-94
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	1166556	35.418
Heating Loads	794157	24.111

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	619098	18.796	619098	18.796
Natural Gas	1549036	47.030	1549036	47.030
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	2168134	65.827	2168134	65.827
Electric	1693033	51.402	1693033	51.402
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1693033	51.402	1693033	51.402
>>> GRAND TOTAL	3861166	117.229	3861166	117.229

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
Gross floor area................: 32937 sqft
Conditioned floor area..........: 32937 sqft

BUILDING 247

ANNUAL ENERGY COSTS

Building: Building 247 - Baseline 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	<---- Annual Costs -----> ($)	($/sqft)*	% of Total
Electric	592897 kWh	11668	0.079	18.6 %
Natural Gas	38163 Therm	23199	0.157	36.9 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		34868	0.235	55.5 %
Electric	1422880 kWh	28002	0.189	44.5 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
>>> Non-HVAC Subtotal		28002	0.189	44.5 %
>>> GRAND TOTAL		62870	0.425	100.0 %

* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 148067 sqft
  Conditioned floor area..........: 143338 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 247 - Baseline   01-05-95
Weather: Washington (Washington TMY)   HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	4151033	28.035
Heating Loads	1875302	12.665

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	2022966	13.663	2022966	13.663
Natural Gas	3816305	25.774	3816305	25.774
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	5839271	39.437	5839271	39.437
Electric	4854866	32.788	4854866	32.788
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	4854866	32.788	4854866	32.788
>>> GRAND TOTAL	10694136	72.225	10694136	72.225

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 148067 sqft
  Conditioned floor area..........: 143338 sqft

ANNUAL ENERGY COSTS

Building: Building 247 - PLC
Weather: Washington (Washington TMY)
Prepared by: EINHORN YAFFEE PRESCOTT

01-05-95
HAP v3.04

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	406978 kWh	8009	0.054	15.3 %
Natural Gas	27010 Therm	16419	0.111	31.3 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		24429	0.165	46.6 %
Electric	1422880 kWh	28002	0.189	53.4 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
>>> Non-HVAC Subtotal		28002	0.189	53.4 %
>>> GRAND TOTAL		52431	0.354	100.0 %

* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 148067 sqft
  Conditioned floor area..........: 143338 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 247 - PLC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	3847929	25.988
Heating Loads	1261435	8.519

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	1388610	9.378	1388610	9.378
Natural Gas	2701007	18.242	2701007	18.242
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	4089617	27.620	4089617	27.620
Electric	4854866	32.788	4854866	32.788
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	4854866	32.788	4854866	32.788
>>> GRAND TOTAL	8944482	60.408	8944482	60.408

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 148067 sqft
  Conditioned floor area..........: 143338 sqft

ANNUAL ENERGY COSTS

Building: Building 247 - DDC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	404356 kWh	7958	0.054	15.2 %
Natural Gas	27079 Therm	16462	0.111	31.4 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		24419	0.165	46.6 %
Electric	1422880 kWh	28002	0.189	53.4 %
Natural Gas	0 Therm	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0	0	0.000	0.0 %
>>> Non-HVAC Subtotal		28002	0.189	53.4 %
>>> GRAND TOTAL		52422	0.354	100.0 %

* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 148067 sqft
  Conditioned floor area..........: 143338 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 247 - DDC | 01-05-95
Weather: Washington (Washington TMY) | HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT |

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	3785796	25.568
Heating Loads	1265145	8.544

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	1379663	9.318	1379663	9.318
Natural Gas	2707936	18.289	2707936	18.289
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	4087599	27.606	4087599	27.606
Electric	4854866	32.788	4854866	32.788
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	4854866	32.788	4854866	32.788
>>> GRAND TOTAL	8942464	60.395	8942464	60.395

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 148067 sqft
  Conditioned floor area..........: 143338 sqft

BUILDING 1425

ANNUAL ENERGY COSTS

Building: Building 1425 - NO EMS 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	72273 kWh	1422	0.092	20.1 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	242 1000 lb	1934	0.125	27.3 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		3356	0.218	47.3 %
Electric	189882 kWh	3737	0.242	52.7 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		3737	0.242	52.7 %
>>> GRAND TOTAL		7093	0.460	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area...............: 15430 sqft
Conditioned floor area.........: 13736 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 1425 - NO EMS 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	452461	29.323
Heating Loads	217148	14.073

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	246594	15.981	246594	15.981
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	242365	15.707	242365	15.707
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	488959	31.689	488959	31.689
Electric	647876	41.988	647876	41.988
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	647876	41.988	647876	41.988
>>> GRAND TOTAL	1136836	73.677	1136836	73.677

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 15430 sqft
  Conditioned floor area..........: 13736 sqft

ANNUAL ENERGY COSTS

Building: Building 1425 - PLC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	56679 kWh	1115	0.072	20.6 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	70 1000 lb	560	0.036	10.3 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		1675	0.109	31.0 %
Electric	189882 kWh	3737	0.242	69.0 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		3737	0.242	69.0 %
>>> GRAND TOTAL		5412	0.351	100.0 %

* Cost per unit floor area is based on the gross building floor area.
    Gross floor area................: 15430 sqft
    Conditioned floor area..........: 13736 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 1425 - PLC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	395459	25.629
Heating Loads	64983	4.211

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	Site Energy* (kBTU)	Site Energy* (kBTU/sqft)*	Source Energy* (kBTU)	Source Energy* (kBTU/sqft)*
Electric	193390	12.533	193390	12.533
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	70176	4.548	70176	4.548
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	263566	17.081	263566	17.081
Electric	647876	41.988	647876	41.988
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	647876	41.988	647876	41.988
>>> GRAND TOTAL	911442	59.069	911442	59.069

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 15430 sqft
  Conditioned floor area.........: 13736 sqft

ANNUAL ENERGY COSTS

Building: Building 1425 - DDC
Weather: Washington (Washington TMY)
Prepared by: EINHORN YAFFEE PRESCOTT

01-05-95
HAP v3.04

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	<---- Annual Costs -----> ($)	($/sqft)*	% of Total
Electric	56679 kWh	1115	0.072	20.6 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	70 1000 lb	560	0.036	10.3 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		1675	0.109	31.0 %
Electric	189882 kWh	3737	0.242	69.0 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		3737	0.242	69.0 %
>>> GRAND TOTAL		5412	0.351	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area................: 15430 sqft
Conditioned floor area..........: 13736 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 1425 - DDC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	395459	25.629
Heating Loads	64983	4.211

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	193390	12.533	193390	12.533
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	70176	4.548	70176	4.548
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	263566	17.081	263566	17.081
Electric	647876	41.988	647876	41.988
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	647876	41.988	647876	41.988
>>> GRAND TOTAL	911442	59.069	911442	59.069

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 15430 sqft
  Conditioned floor area..........: 13736 sqft

BUILDING 3136

ANNUAL ENERGY COSTS

Building: Building 3136 - Baseline 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	82975 kWh	1633	0.139	16.4 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	413 1000 lb	3292	0.280	33.0 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		4925	0.419	49.4 %
Electric	256487 kWh	5048	0.429	50.6 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		5048	0.429	50.6 %
>>> GRAND TOTAL		9973	0.848	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area................: 11760 sqft
Conditioned floor area..........: 10600 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 3136 - Baseline | 01-05-95
Weather: Washington (Washington TMY) | HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT |

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	566514	48.173
Heating Loads	360888	30.688

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	283111	24.074	283111	24.074
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	412547	35.080	412547	35.080
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	695657	59.155	695657	59.155
Electric	875133	74.416	875133	74.416
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	875133	74.416	875133	74.416
>>> GRAND TOTAL	1570791	133.571	1570791	133.571

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 11760 sqft
  Conditioned floor area..........: 10600 sqft

ANNUAL ENERGY COSTS

Building: Building 3136 - PLC
Weather: Washington (Washington TMY)
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	75724 kWh	1490	0.127	17.8 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	228 1000 lb	1818	0.155	21.8 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		3308	0.281	39.6 %
Electric	256487 kWh	5048	0.429	60.4 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		5048	0.429	60.4 %
>>> GRAND TOTAL		8356	0.711	100.0 %

* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 11760 sqft
  Conditioned floor area..........: 10600 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 3136 - PLC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	499102	42.441
Heating Loads	207526	17.647

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	258369	21.970	258369	21.970
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	227850	19.375	227850	19.375
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	486219	41.345	486219	41.345
Electric	875133	74.416	875133	74.416
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	875133	74.416	875133	74.416
>>> GRAND TOTAL	1361352	115.761	1361352	115.761

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 11760 sqft
  Conditioned floor area..........: 10600 sqft

ANNUAL ENERGY COSTS

Building: Building 3136 - DDC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. COSTS BY ENERGY CATEGORY

Component	Annual Energy	Annual Costs ($)	Annual Costs ($/sqft)*	% of Total
Electric	75724 kWh	1490	0.127	17.8 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	228 1000 lb	1818	0.155	21.8 %
Remote Cooling	0	0	0.000	0.0 %
>>> HVAC Subtotal		3308	0.281	39.6 %
Electric	256487 kWh	5048	0.429	60.4 %
Natural Gas	0	0	0.000	0.0 %
Fuel Oil	0	0	0.000	0.0 %
Propane	0	0	0.000	0.0 %
Remote Heating	0 1000 lb	0	0.000	0.0 %
>>> Non-HVAC Subtotal		5048	0.429	60.4 %
>>> GRAND TOTAL		8356	0.711	100.0 %

* Cost per unit floor area is based on the gross building floor area.
Gross floor area...............: 11760 sqft
Conditioned floor area..........: 10600 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Building 3136 - DDC 01-05-95
Weather: Washington (Washington TMY) HAP v3.04
Prepared by: EINHORN YAFFEE PRESCOTT

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	499102	42.441
Heating Loads	207526	17.647

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	258369	21.970	258369	21.970
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	227850	19.375	227850	19.375
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	486219	41.345	486219	41.345
Electric	875133	74.416	875133	74.416
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	875133	74.416	875133	74.416
>>> GRAND TOTAL	1361352	115.761	1361352	115.761

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 11760 sqft
  Conditioned floor area.........: 10600 sqft

APPENDIX E
BLCC 4.2
LIFE CYCLE COST ANALYSIS
INPUT DATA

BUILDING 200

```
***********************************************************************
*   N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-)  *
***********************************************************************
```

FILE NAME: 200-BASE
FILE LAST MODIFIED ON 08-16-1995/12:30:38
PROJECT ALTERNATIVE: BLDG200-BASE
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 8495

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	727922	29904
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	1700.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69
2003	1.09	4.99

2004	0.62	3.47
2005	0.00	0.00

```
*****************************************************************************
*   N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-)  *
*****************************************************************************
```

FILE NAME: 200-FMR
FILE LAST MODIFIED ON 08-16-1995/12:31:31
PROJECT ALTERNATIVE: BLDG200-FMR
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	1115
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 8495

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

		TYPE 1	TYPE 2
ENERGY TYPE:		Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:		727922	29904
UNITS:		kWh	Therm
PRICE PER UNIT ($):		0.020	0.608
ANNUAL DEMAND CHARGE ($):		0.00	0.00
ESCALATION RATE METHOD:		DOE rates	DOE rates
	1995	0.39	3.38
	1996	0.24	1.98
	1997	0.38	3.16
	1998	0.59	4.11
	1999	1.24	4.75
	2000	1.12	5.03
	2001	0.67	5.22
	2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
***********************************************************************
*  N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-)  *
***********************************************************************
```

FILE NAME: 200-PLC
FILE LAST MODIFIED ON 08-16-1995/12:32:22
PROJECT ALTERNATIVE: BLDG200-PLC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	12711
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 8495

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	666966	22171
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	1700.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
***************************************************************************
*   N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
***************************************************************************
```

FILE NAME: 200-DDC
FILE LAST MODIFIED ON 08-16-1995/12:33:30
PROJECT ALTERNATIVE: BLDG200-DDC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	78764
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 2935

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	628377	18411
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

BUILDING 219

```
****************************************************************************
*   N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
****************************************************************************
```

FILE NAME: 219-BASE
FILE LAST MODIFIED ON 08-16-1995/12:34:45
PROJECT ALTERNATIVE: BLDG219-BASE
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 6090

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	903608	25043
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	1708.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
***************************************************************************
*   N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
***************************************************************************
```

FILE NAME: 219-FMR
FILE LAST MODIFIED ON 08-16-1995/12:35:26
PROJECT ALTERNATIVE: BLDG219-FMR
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	1673
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 6090

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	903608	25043
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
*****************************************************************************
*   N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
*****************************************************************************
```

FILE NAME: 219-PLC
FILE LAST MODIFIED ON 08-16-1995/12:36:13
PROJECT ALTERNATIVE: BLDG219-PLC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	12516
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 6090

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	696551	16265
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	1708.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
****************************************************************************
*   N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-)  *
****************************************************************************
```

FILE NAME: 219-DDC
FILE LAST MODIFIED ON 08-16-1995/12:36:51
PROJECT ALTERNATIVE: BLDG219-DDC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	72141
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 2380

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	677647	15490
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

BUILDING 247

```
***************************************************************************
*   N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-)  *
***************************************************************************
```

FILE NAME: 247-BASE
FILE LAST MODIFIED ON 08-16-1995/12:37:40
PROJECT ALTERNATIVE: BLDG247-BASE
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 14815

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	2045422	40071
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	3070.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
****************************************************************************
*   N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
****************************************************************************
```

FILE NAME: 247-FMR
FILE LAST MODIFIED ON 08-16-1995/12:38:24
PROJECT ALTERNATIVE: BLDG247-FMR
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	558
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 14815

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	2045422	40071
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
*************************************************************************
*  N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-)  *
*************************************************************************
```

FILE NAME: 247-PLC
FILE LAST MODIFIED ON 08-16-1995/12:39:17
PROJECT ALTERNATIVE: BLDG247-PLC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	14914
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 14815

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	1850207	28361
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	3070.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
***************************************************************************
*  N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-)  *
***************************************************************************
```

FILE NAME: 247-DDC
FILE LAST MODIFIED ON 08-16-1995/12:40:06
PROJECT ALTERNATIVE: BLDG247-DDC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	87416
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 12515

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	1827236	27079
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.020	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22
2002	1.00	5.69

2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

BUILDING 1425

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*************************************************************************
*   N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)   *
*************************************************************************
```

FILE NAME: 1425BASE
FILE LAST MODIFIED ON 08-16-1995/12:41:14
PROJECT ALTERNATIVE: BLDG1425BASE
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 4930

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Central Stea
BASE ANNUAL CONSUMPTION:	265769	254000
UNITS:	kWh	Pound
PRICE PER UNIT ($):	0.020	0.008
ANNUAL DEMAND CHARGE ($):	456.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
IF DOE ESC, ENERGY TYPE:	Electricity	Natural Gas
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22

2002	1.00	5.69
2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
***************************************************************************
*   N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
***************************************************************************
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FILE NAME: 1425-FMS
FILE LAST MODIFIED ON 08-16-1995/12:42:35
PROJECT ALTERNATIVE: BLDG1425-FMR
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	558
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 4930

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Central Stea
BASE ANNUAL CONSUMPTION:	265769	254000
UNITS:	kWh	Pound
PRICE PER UNIT ($):	0.020	0.008
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
IF DOE ESC, ENERGY TYPE:	Electricity	Natural Gas
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22

2002	1.00	5.69
2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
******************************************************************************
*  N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
******************************************************************************
```

FILE NAME: 1425-PLC
FILE LAST MODIFIED ON 08-16-1995/12:44:05
PROJECT ALTERNATIVE: BLDG1425-PLC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	11518
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 4930

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Central Stea
BASE ANNUAL CONSUMPTION:	249395	73500
UNITS:	kWh	Pound
PRICE PER UNIT ($):	0.020	0.008
ANNUAL DEMAND CHARGE ($):	456.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
IF DOE ESC, ENERGY TYPE:	Electricity	Natural Gas
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22

2002	1.00	5.69
2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
*************************************************************************
*  N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-) *
*************************************************************************
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FILE NAME: 1425-DDC
FILE LAST MODIFIED ON 08-16-1995/12:44:58
PROJECT ALTERNATIVE: BLDG1425-DDC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	48993
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 3670

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Central Stea
BASE ANNUAL CONSUMPTION:	246561	70000
UNITS:	kWh	Pound
PRICE PER UNIT ($):	0.020	0.008
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
IF DOE ESC, ENERGY TYPE:	Electricity	Natural Gas
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22

2002	1.00	5.69
2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

BUILDING 3136

```
*****************************************************************************
*   N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-)   *
*****************************************************************************
```

FILE NAME: 3136BASE
FILE LAST MODIFIED ON 08-16-1995/12:45:55
PROJECT ALTERNATIVE: BLDG3136BASE
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 2345

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Central Stea
BASE ANNUAL CONSUMPTION:	346101	433650
UNITS:	kWh	Pound
PRICE PER UNIT ($):	0.020	0.008
ANNUAL DEMAND CHARGE ($):	456.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
IF DOE ESC, ENERGY TYPE:	Electricity	Natural Gas
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22

2002	1.00	5.69
2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
*************************************************************************
*  N I S T  B L C C   I N P U T  D A T A  L I S T I N G (version 4.20-) *
*************************************************************************
```

FILE NAME: 3136-FMR
FILE LAST MODIFIED ON 08-16-1995/12:46:31
PROJECT ALTERNATIVE: BLDG3136-FMR
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	558
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 2345

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Central Stea
BASE ANNUAL CONSUMPTION:	346101	433650
UNITS:	kWh	Pound
PRICE PER UNIT ($):	0.020	0.008
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
IF DOE ESC, ENERGY TYPE:	Electricity	Natural Gas
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22

2002	1.00	5.69
2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

```
*************************************************************************
*  N I S T  B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
*************************************************************************
```

FILE NAME: 3136-PLC
FILE LAST MODIFIED ON 08-16-1995/12:47:37
PROJECT ALTERNATIVE: BLDG3136-PLC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	10646
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 2345

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Central Stea
BASE ANNUAL CONSUMPTION:	335997	239400
UNITS:	kWh	Pound
PRICE PER UNIT ($):	0.020	0.008
ANNUAL DEMAND CHARGE ($):	456.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
IF DOE ESC, ENERGY TYPE:	Electricity	Natural Gas
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22

```
****************************************************************************
*   N I S T   B L C C   I N P U T   D A T A   L I S T I N G (version 4.20-)  *
****************************************************************************
```

FILE NAME: 3136-DDC
FILE LAST MODIFIED ON 08-16-1995/12:48:09
PROJECT ALTERNATIVE: BLDG3136-DDC
COMMENT: (NONE)

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 10 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	48614
EXPECTED ASSET LIFE (YRS/MTHS)	10/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 1265

No non-annually-recurring OM&R costs reported.

ENERGY-RELATED DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Industrial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Central Stea
BASE ANNUAL CONSUMPTION:	332211	228000
UNITS:	kWh	Pound
PRICE PER UNIT ($):	0.020	0.008
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	DOE rates	DOE rates
IF DOE ESC, ENERGY TYPE:	Electricity	Natural Gas
1995	0.39	3.38
1996	0.24	1.98
1997	0.38	3.16
1998	0.59	4.11
1999	1.24	4.75
2000	1.12	5.03
2001	0.67	5.22

2002	1.00	5.69
2003	1.09	4.99
2004	0.62	3.47
2005	0.00	0.00

APPENDIX F
BLCC 4.2
LIFE CYCLE COST ANALYSIS RESULTS

BUILDING 200

BLCC SUMMARY FOR BLDG200-BASE

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$0	$0
ANNUALLY RECURRING OM&R COSTS	$72,096	$8,495
ENERGY COSTS	$335,417	$39,522
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$407,513	$48,017

BLCC SUMMARY FOR BLDG200-FMR

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$1,000	$118
ANNUALLY RECURRING OM&R COSTS	$72,096	$8,495
ENERGY COSTS	$320,509	$37,765
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$393,604	$46,378

BLCC SUMMARY FOR BLDG200-PLC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$11,400	$1,343
ANNUALLY RECURRING OM&R COSTS	$72,096	$8,495
ENERGY COSTS	$275,815	$32,499
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$359,311	$42,337

BLCC SUMMARY FOR BLDG200-DDC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$78,764	$9,281
ANNUALLY RECURRING OM&R COSTS	$24,909	$2,935
ENERGY COSTS	$226,660	$26,707
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$330,333	$38,923

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG200-BASE
ALTERNATIVE: BLDG200-FMR

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 200-BASE.LCC
ALTERNATIVE LCC FILE: 200-FMR.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG200-BASE	ALTERNATIVE: BLDG200-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$1,115	-$1,115
SUBTOTAL	$0	$1,115	-$1,115
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$72,096	$72,096	$0
ENERGY-RELATED COSTS	$331,719	$316,810	$14,909
SUBTOTAL	$403,814	$388,906	$14,909
TOTAL P.V. LIFE-CYCLE COST	$403,814	$390,021	$13,794

NET SAVINGS FROM ALTERNATIVE BLDG200-FMR COMPARED TO ALTERNATIVE BLDG200-BASE

Net Savings	=	P.V. of non-investment savings	$14,909
	-	Increased total investment	$1,115
		Net Savings:	$13,794

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG200-FMR COMPARED TO ALTERNATIVE BLDG200-BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 13.37$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG200-FMR COMPARED TO ALTERNATIVE BLDG200-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 33.62%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 1
Discounted Payback occurs in year 1

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	kWh	727,922	727,922	0	0
Natural Gas	Therm	29,904	29,904	0	0

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO_2 (Mg):	422.8	422.8	0.0	0.0
SOx (Kg):	3,552.7	3,552.7	0.0	0.0
NOx (Kg):	1,813.6	1,813.6	0.0	0.0
Natural Gas:				
CO_2 (Mg):	157.9	157.9	0.0	0.0
SOx (Kg):	0.9	0.9	0.0	0.0
NOx (Kg):	119.6	119.6	0.0	0.0
Total:				
CO_2 (Mg):	580.8	580.8	0.0	0.0
SOx (Kg):	3,553.6	3,553.6	0.0	0.0
NOx (Kg):	1,933.2	1,933.2	0.0	0.0

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG200-BASE
ALTERNATIVE: BLDG200-PLC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 200-BASE.LCC
ALTERNATIVE LCC FILE: 200-PLC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG200-BASE	ALTERNATIVE: BLDG200-PLC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$12,711	-$12,711
SUBTOTAL	$0	$12,711	-$12,711
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$72,096	$72,096	$0
ENERGY-RELATED COSTS	$331,719	$272,118	$59,601
SUBTOTAL	$403,814	$344,214	$59,601
TOTAL P.V. LIFE-CYCLE COST	$403,814	$356,925	$46,890

NET SAVINGS FROM ALTERNATIVE BLDG200-PLC COMPARED TO ALTERNATIVE BLDG200-BASE

Net Savings	=	P.V. of non-investment savings	$59,601
	-	Increased total investment	$12,711
		Net Savings:	$46,890

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG200-PLC COMPARED TO ALTERNATIVE BLDG200-BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 4.69$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG200-PLC COMPARED TO ALTERNATIVE BLDG200-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 20.33%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 3
Discounted Payback occurs in year 3

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption: Base Case	Annual Consumption: Alternative	Annual Consumption: Savings	Life-Cycle Savings
Electricity	kWh	727,922	666,966	60,956	609,560
Natural Gas	Therm	29,904	22,171	7,733	77,330

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions: Base Case	Annual Emissions: Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	422.8	387.4	35.4	354.1
SOx (Kg):	3,552.7	3,255.2	297.5	1,856.4
NOx (Kg):	1,813.6	1,661.7	151.9	1,518.7
Natural Gas:				
CO2 (Mg):	157.9	117.1	40.8	408.4
SOx (Kg):	0.9	0.7	0.2	0.0
NOx (Kg):	119.6	88.7	30.9	309.3
Total:				
CO2 (Mg):	580.8	504.5	76.2	762.5
SOx (Kg):	3,553.6	3,255.8	297.7	1,856.4
NOx (Kg):	1,933.2	1,750.4	182.8	1,828.0

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG200-BASE
ALTERNATIVE: BLDG200-DDC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 200-BASE.LCC
ALTERNATIVE LCC FILE: 200-DDC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG200-BASE	ALTERNATIVE: BLDG200-DDC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$78,764	-$78,764
SUBTOTAL	$0	$78,764	-$78,764
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$72,096	$24,909	$47,187
ENERGY-RELATED COSTS	$331,719	$226,660	$105,059
SUBTOTAL	$403,814	$251,569	$152,246
TOTAL P.V. LIFE-CYCLE COST	$403,814	$330,333	$73,482

NET SAVINGS FROM ALTERNATIVE BLDG200-DDC COMPARED TO ALTERNATIVE BLDG200-BASE

Net Savings	=	P.V. of non-investment savings	$152,246
	-	Increased total investment	$78,764
		Net Savings:	$73,482

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG200-DDC COMPARED TO ALTERNATIVE BLDG200-BASE

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 1.93$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG200-DDC COMPARED TO ALTERNATIVE BLDG200-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 10.12%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 5
Discounted Payback occurs in year 6

ENERGY SAVINGS SUMMARY

Energy type	Units	-------- Annual Consumption ---------			Life-Cycle Savings
		Base Case	Alternative	Savings	
Electricity	kWh	727,922	628,377	99,545	995,450
Natural Gas	Therm	29,904	18,411	11,493	114,930

EMISSIONS REDUCTION SUMMARY

Energy type	--- Annual Emissions ---		Annual Reduction	Life-Cycle Reduction
	Base Case	Alternative		
Electricity:				
CO_2 (Mg):	422.8	365.0	57.8	578.2
SOx (Kg):	3,552.7	3,066.8	485.8	3,031.6
NOx (Kg):	1,813.6	1,565.6	248.0	2,480.1
Natural Gas:				
CO_2 (Mg):	157.9	97.2	60.7	606.9
SOx (Kg):	0.9	0.6	0.3	0.0
NOx (Kg):	119.6	73.6	46.0	459.7
Total:				
CO_2 (Mg):	580.8	462.2	118.5	1,185.2
SOx (Kg):	3,553.6	3,067.4	486.2	3,031.6
NOx (Kg):	1,933.2	1,639.2	294.0	2,939.8

BUILDING 219

BLCC SUMMARY FOR BLDG219-BASE

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$0	$0
ANNUALLY RECURRING OM&R COSTS	$51,685	$6,090
ENERGY COSTS	$331,859	$39,103
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$383,544	$45,193

BLCC SUMMARY FOR BLDG219-FMR

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$1,673	$197
ANNUALLY RECURRING OM&R COSTS	$51,685	$6,090
ENERGY COSTS	$316,880	$37,338
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$370,238	$43,625

BLCC SUMMARY FOR BLDG219-PLC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$12,516	$1,475
ANNUALLY RECURRING OM&R COSTS	$51,685	$6,090
ENERGY COSTS	$240,024	$28,282
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$304,225	$35,847

BLCC SUMMARY FOR BLDG219-DDC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$72,141	$8,500
ANNUALLY RECURRING OM&R COSTS	$20,199	$2,380
ENERGY COSTS	$216,827	$25,549
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$309,167	$36,429

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG219-BASE
ALTERNATIVE: BLDG219-FMR

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 219-BASE.LCC
ALTERNATIVE LCC FILE: 219-FMR.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG219-BASE	ALTERNATIVE: BLDG219-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$1,673	-$1,673
SUBTOTAL	$0	$1,673	-$1,673
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$51,685	$51,685	$0
ENERGY-RELATED COSTS	$331,859	$316,880	$14,979
SUBTOTAL	$383,544	$368,565	$14,979
TOTAL P.V. LIFE-CYCLE COST	$383,544	$370,238	$13,306

NET SAVINGS FROM ALTERNATIVE BLDG219-FMR COMPARED TO ALTERNATIVE BLDG219-BASE

Net Savings	=	P.V. of non-investment savings	$14,979
	-	Increased total investment	$1,673
		Net Savings:	$13,306

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG219-FMR COMPARED TO ALTERNATIVE BLDG219-BASE

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 8.95$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG219-FMR COMPARED TO ALTERNATIVE BLDG219-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 28.37%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 1
Discounted Payback occurs in year 2

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	kWh	903,608	903,608	0	0
Natural Gas	Therm	25,043	25,043	0	0

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO_2 (Mg):	524.9	524.9	0.0	0.0
SOx (Kg):	4,410.1	4,410.1	0.0	0.0
NOx (Kg):	2,251.3	2,251.3	0.0	0.0
Natural Gas:				
CO_2 (Mg):	132.3	132.3	0.0	0.0
SOx (Kg):	0.8	0.8	0.0	0.0
NOx (Kg):	100.2	100.2	0.0	0.0
Total:				
CO_2 (Mg):	657.1	657.1	0.0	0.0
SOx (Kg):	4,410.9	4,410.9	0.0	0.0
NOx (Kg):	2,351.5	2,351.5	0.0	0.0

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG219-BASE
ALTERNATIVE: BLDG219-PLC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 219-BASE.LCC
ALTERNATIVE LCC FILE: 219-PLC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG219-BASE	ALTERNATIVE: BLDG219-PLC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$12,516	-$12,516
SUBTOTAL	$0	$12,516	-$12,516
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$51,685	$51,685	$0
ENERGY-RELATED COSTS	$331,859	$240,024	$91,836
SUBTOTAL	$383,544	$291,709	$91,836
TOTAL P.V. LIFE-CYCLE COST	$383,544	$304,225	$79,320

NET SAVINGS FROM ALTERNATIVE BLDG219-PLC COMPARED TO ALTERNATIVE BLDG219-BASE

Net Savings	=	P.V. of non-investment savings	$91,836
	-	Increased total investment	$12,516
		Net Savings:	$79,320

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG219-PLC COMPARED TO ALTERNATIVE BLDG219-BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 7.34$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG219-PLC COMPARED TO ALTERNATIVE BLDG219-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 25.84%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 2
Discounted Payback occurs in year 2

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	903,608	696,551	207,057	2,070,570
Natural Gas	Therm	25,043	16,265	8,778	87,780

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	524.9	404.6	120.3	1,202.8
SOx (Kg):	4,410.1	3,399.5	1,010.6	6,305.8
NOx (Kg):	2,251.3	1,735.4	515.9	5,158.8
Natural Gas:				
CO2 (Mg):	132.3	85.9	46.4	463.6
SOx (Kg):	0.8	0.5	0.3	0.0
NOx (Kg):	100.2	65.1	35.1	351.1
Total:				
CO2 (Mg):	657.1	490.5	166.6	1,666.3
SOx (Kg):	4,410.9	3,400.0	1,010.8	6,305.8
NOx (Kg):	2,351.5	1,800.5	551.0	5,509.9

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG219-BASE
ALTERNATIVE: BLDG219-DDC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 219-BASE.LCC
ALTERNATIVE LCC FILE: 219-DDC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG219-BASE	ALTERNATIVE: BLDG219-DDC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$72,141	-$72,141
SUBTOTAL	$0	$72,141	-$72,141
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$51,685	$20,199	$31,486
ENERGY-RELATED COSTS	$331,859	$216,827	$115,032
SUBTOTAL	$383,544	$237,026	$146,518
TOTAL P.V. LIFE-CYCLE COST	$383,544	$309,167	$74,377

NET SAVINGS FROM ALTERNATIVE BLDG219-DDC COMPARED TO ALTERNATIVE BLDG219-BASE

Net Savings	=	P.V. of non-investment savings	$146,518
	-	Increased total investment	$72,141
		Net Savings:	$74,377

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG219-DDC COMPARED TO ALTERNATIVE BLDG219-BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 2.03$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG219-DDC COMPARED TO ALTERNATIVE BLDG219-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 10.67%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 5
Discounted Payback occurs in year 5

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	903,608	677,647	225,961	2,259,610
Natural Gas	Therm	25,043	15,490	9,553	95,530

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	524.9	393.6	131.3	1,312.6
SOx (Kg):	4,410.1	3,307.3	1,102.8	6,881.6
NOx (Kg):	2,251.3	1,688.3	563.0	5,629.7
Natural Gas:				
CO2 (Mg):	132.3	81.8	50.4	504.5
SOx (Kg):	0.8	0.5	0.3	0.0
NOx (Kg):	100.2	62.0	38.2	382.1
Total:				
CO2 (Mg):	657.1	475.4	181.7	1,817.1
SOx (Kg):	4,410.9	3,307.8	1,103.1	6,881.6
NOx (Kg):	2,351.5	1,750.3	601.2	6,011.9

BUILDING 247

BLCC SUMMARY FOR BLDG247-BASE

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$0	$0
ANNUALLY RECURRING OM&R COSTS	$125,733	$14,815
ENERGY COSTS	$639,123	$75,308
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$764,855	$90,123

BLCC SUMMARY FOR BLDG247-FMR

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$558	$66
ANNUALLY RECURRING OM&R COSTS	$125,733	$14,815
ENERGY COSTS	$612,199	$72,135
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$738,489	$87,016

BLCC SUMMARY FOR BLDG247-PLC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$14,914	$1,757
ANNUALLY RECURRING OM&R COSTS	$125,733	$14,815
ENERGY COSTS	$530,820	$62,546
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$671,467	$79,119

BLCC SUMMARY FOR BLDG247-DDC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$87,416	$10,300
ANNUALLY RECURRING OM&R COSTS	$106,213	$12,515
ENERGY COSTS	$491,759	$57,944
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$685,388	$80,759

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG247-BASE
ALTERNATIVE: BLDG247-FMR

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 247-BASE.LCC
ALTERNATIVE LCC FILE: 247-FMR.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG247-BASE	ALTERNATIVE: BLDG247-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$558	-$558
SUBTOTAL	$0	$558	-$558
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$125,733	$125,733	$0
ENERGY-RELATED COSTS	$639,123	$612,199	$26,923
SUBTOTAL	$764,855	$737,932	$26,923
TOTAL P.V. LIFE-CYCLE COST	$764,855	$738,489	$26,366

NET SAVINGS FROM ALTERNATIVE BLDG247-FMR COMPARED TO ALTERNATIVE BLDG247-BASE

Net Savings	=	P.V. of non-investment savings	$26,923
	-	Increased total investment	$558
		Net Savings:	$26,366

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG247-FMR COMPARED TO ALTERNATIVE BLDG247-BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 48.29$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG247-FMR COMPARED TO ALTERNATIVE BLDG247-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 51.93%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 1
Discounted Payback occurs in year 1

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	2,045,422	2,045,422	0	0
Natural Gas	Therm	40,071	40,071	0	0

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	1,188.2	1,188.2	0.0	0.0
SOx (Kg):	9,982.8	9,982.8	0.0	0.0
NOx (Kg):	5,096.1	5,096.1	0.0	0.0
Natural Gas:				
CO2 (Mg):	211.6	211.6	0.0	0.0
SOx (Kg):	1.2	1.2	0.0	0.0
NOx (Kg):	160.3	160.3	0.0	0.0
Total:				
CO2 (Mg):	1,399.8	1,399.8	0.0	0.0
SOx (Kg):	9,984.0	9,984.0	0.0	0.0
NOx (Kg):	5,256.4	5,256.4	0.0	0.0

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG247-BASE
ALTERNATIVE: BLDG247-PLC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 247-BASE.LCC
ALTERNATIVE LCC FILE: 247-PLC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG247-BASE	ALTERNATIVE: BLDG247-PLC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$14,914	-$14,914
SUBTOTAL	$0	$14,914	-$14,914
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$125,733	$125,733	$0
ENERGY-RELATED COSTS	$639,123	$530,820	$108,303
SUBTOTAL	$764,855	$656,553	$108,303
TOTAL P.V. LIFE-CYCLE COST	$764,855	$671,467	$93,389

NET SAVINGS FROM ALTERNATIVE BLDG247-PLC COMPARED TO ALTERNATIVE BLDG247-BASE

Net Savings	=	P.V. of non-investment savings	$108,303
	-	Increased total investment	$14,914
		Net Savings:	$93,389

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG247-PLC COMPARED TO ALTERNATIVE BLDG247-BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 7.26$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG247-PLC COMPARED TO ALTERNATIVE BLDG247-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 25.71%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 2
Discounted Payback occurs in year 2

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	2,045,422	1,850,207	195,215	1,952,150
Natural Gas	Therm	40,071	28,361	11,710	117,100

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	1,188.2	1,074.8	113.4	1,134.0
SOx (Kg):	9,982.8	9,030.0	952.8	5,945.2
NOx (Kg):	5,096.1	4,609.7	486.4	4,863.7
Natural Gas:				
CO2 (Mg):	211.6	149.8	61.8	618.4
SOx (Kg):	1.2	0.9	0.4	0.0
NOx (Kg):	160.3	113.4	46.8	468.4
Total:				
CO2 (Mg):	1,399.8	1,224.5	175.2	1,752.4
SOx (Kg):	9,984.0	9,030.9	953.1	5,945.2
NOx (Kg):	5,256.4	4,723.2	533.2	5,332.1

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG247-BASE
ALTERNATIVE: BLDG247-DDC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 247-BASE.LCC
ALTERNATIVE LCC FILE: 247-DDC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG247-BASE	ALTERNATIVE: BLDG247-DDC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$87,416	-$87,416
SUBTOTAL	$0	$87,416	-$87,416
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$125,733	$106,213	$19,520
ENERGY-RELATED COSTS	$639,123	$491,759	$147,363
SUBTOTAL	$764,855	$597,972	$166,883
TOTAL P.V. LIFE-CYCLE COST	$764,855	$685,388	$79,467

NET SAVINGS FROM ALTERNATIVE BLDG247-DDC COMPARED TO ALTERNATIVE BLDG247-BASE

Net Savings	=	P.V. of non-investment savings	$166,883
	-	Increased total investment	$87,416
		Net Savings:	$79,467

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG247-DDC COMPARED TO ALTERNATIVE BLDG247-BASE

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 1.91$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG247-DDC COMPARED TO ALTERNATIVE BLDG247-BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 9.99%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 5
Discounted Payback occurs in year 6

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	2,045,422	1,827,236	218,186	2,181,860
Natural Gas	Therm	40,071	27,079	12,992	129,920

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO_2 (Mg):	1,188.2	1,061.4	126.7	1,267.4
SOx (Kg):	9,982.8	8,917.9	1,064.9	6,644.8
NOx (Kg):	5,096.1	4,552.5	543.6	5,436.0
Natural Gas:				
CO_2 (Mg):	211.6	143.0	68.6	686.1
SOx (Kg):	1.2	0.8	0.4	0.0
NOx (Kg):	160.3	108.3	52.0	519.7
Total:				
CO_2 (Mg):	1,399.8	1,204.4	195.4	1,953.5
SOx (Kg):	9,984.0	8,918.7	1,065.3	6,644.8
NOx (Kg):	5,256.4	4,660.8	595.6	5,955.7

BUILDING 1425

BLCC SUMMARY FOR BLDG1425BASE

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$0	$0
ANNUALLY RECURRING OM&R COSTS	$41,840	$4,930
ENERGY COSTS	$71,752	$8,455
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$113,592	$13,385

BLCC SUMMARY FOR BLDG1425-FMR

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$558	$66
ANNUALLY RECURRING OM&R COSTS	$41,840	$4,930
ENERGY COSTS	$67,753	$7,983
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$110,151	$12,979

BLCC SUMMARY FOR BLDG1425-PLC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$11,518	$1,357
ANNUALLY RECURRING OM&R COSTS	$41,840	$4,930
ENERGY COSTS	$53,859	$6,346
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$107,217	$12,633

BLCC SUMMARY FOR BLDG1425-DDC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$48,993	$5,773
ANNUALLY RECURRING OM&R COSTS	$31,147	$3,670
ENERGY COSTS	$49,072	$5,782
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$129,211	$15,225

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG1425BASE
ALTERNATIVE: BLDG1425-FMR

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 1425BASE.LCC
ALTERNATIVE LCC FILE: 1425-FMS.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG1425BASE	ALTERNATIVE: BLDG1425-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$558	-$558
SUBTOTAL	$0	$558	-$558
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$41,840	$41,840	$0
ENERGY-RELATED COSTS	$71,752	$67,753	$3,999
SUBTOTAL	$113,592	$109,593	$3,999
TOTAL P.V. LIFE-CYCLE COST	$113,592	$110,151	$3,442

NET SAVINGS FROM ALTERNATIVE BLDG1425-FMR COMPARED TO ALTERNATIVE BLDG1425BASE

Net Savings	=	P.V. of non-investment savings	$3,999
	-	Increased total investment	$558
		Net Savings:	$3,442

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG1425-FMR COMPARED TO ALTERNATIVE BLDG1425BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 7.17$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG1425-FMR COMPARED TO ALTERNATIVE BLDG1425BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 25.55%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 2
Discounted Payback occurs in year 2

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	265,769	265,769	0	0
Central Steam	Pound	254,000	254,000	0	0

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	154.4	154.4	0.0	0.0
SOx (Kg):	1,297.1	1,297.1	0.0	0.0
NOx (Kg):	662.2	662.2	0.0	0.0
Central Steam:				
CO2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO2 (Mg):	154.4	154.4	0.0	0.0
SOx (Kg):	1,297.1	1,297.1	0.0	0.0
NOx (Kg):	662.2	662.2	0.0	0.0

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG1425BASE
ALTERNATIVE: BLDG1425-PLC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 1425BASE.LCC
ALTERNATIVE LCC FILE: 1425-PLC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG1425BASE	ALTERNATIVE: BLDG1425-PLC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$11,518	-$11,518
SUBTOTAL	$0	$11,518	-$11,518
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$41,840	$41,840	$0
ENERGY-RELATED COSTS	$71,752	$53,859	$17,893
SUBTOTAL	$113,592	$95,699	$17,893
TOTAL P.V. LIFE-CYCLE COST	$113,592	$107,217	$6,375

NET SAVINGS FROM ALTERNATIVE BLDG1425-PLC COMPARED TO ALTERNATIVE BLDG1425BASE

Net Savings	=	P.V. of non-investment savings	$17,893
	-	Increased total investment	$11,518
		Net Savings:	$6,375

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG1425-PLC COMPARED TO ALTERNATIVE BLDG1425BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 1.55$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG1425-PLC COMPARED TO ALTERNATIVE BLDG1425BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 7.74%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 6
Discounted Payback occurs in year 7

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption: Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	kWh	265,769	249,395	16,374	163,740
Central Steam	Pound	254,000	73,500	180,500	1,805,000

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions: Base Case	Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO_2 (Mg):	154.4	144.9	9.5	95.1
SOx (Kg):	1,297.1	1,217.2	79.9	498.7
NOx (Kg):	662.2	621.4	40.8	408.0
Central Steam:				
CO_2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO_2 (Mg):	154.4	144.9	9.5	95.1
SOx (Kg):	1,297.1	1,217.2	79.9	498.7
NOx (Kg):	662.2	621.4	40.8	408.0

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG1425BASE
ALTERNATIVE: BLDG1425-DDC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 1425BASE.LCC
ALTERNATIVE LCC FILE: 1425-DDC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG1425BASE	ALTERNATIVE: BLDG1425-DDC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$48,993	-$48,993
SUBTOTAL	$0	$48,993	-$48,993
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$41,840	$31,147	$10,693
ENERGY-RELATED COSTS	$71,752	$49,072	$22,681
SUBTOTAL	$113,592	$80,218	$33,374
TOTAL P.V. LIFE-CYCLE COST	$113,592	$129,211	-$15,619

NET SAVINGS FROM ALTERNATIVE BLDG1425-DDC COMPARED TO ALTERNATIVE BLDG1425BASE

Net Savings	=	P.V. of non-investment savings	$33,374
	-	Increased total investment	$48,993
		Net Savings:	-$15,619

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG1425-DDC COMPARED TO ALTERNATIVE BLDG1425BASE

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 0.68$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG1425-DDC COMPARED TO ALTERNATIVE BLDG1425BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = -0.78%

ESTIMATED YEARS TO PAYBACK

Simple Payback never reached during study period
Discounted Payback never reached during study period

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	265,769	246,561	19,208	192,080
Central Steam	Pound	254,000	70,000	184,000	1,840,000

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO_2 (Mg):	154.4	143.2	11.2	111.6
SOx (Kg):	1,297.1	1,203.4	93.7	585.0
NOx (Kg):	662.2	614.3	47.9	478.6
Central Steam:				
CO_2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO_2 (Mg):	154.4	143.2	11.2	111.6
SOx (Kg):	1,297.1	1,203.4	93.7	585.0
NOx (Kg):	662.2	614.3	47.9	478.6

BUILDING 3136

F-45

BLCC SUMMARY FOR BLDG3136BASE

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$0	$0
ANNUALLY RECURRING OM&R COSTS	$19,902	$2,345
ENERGY COSTS	$100,793	$11,876
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$120,694	$14,221

BLCC SUMMARY FOR BLDG3136-FMR

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$558	$66
ANNUALLY RECURRING OM&R COSTS	$19,902	$2,345
ENERGY COSTS	$96,794	$11,405
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$117,253	$13,816

BLCC SUMMARY FOR BLDG3136-PLC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$10,646	$1,254
ANNUALLY RECURRING OM&R COSTS	$19,902	$2,345
ENERGY COSTS	$82,855	$9,763
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$113,403	$13,362

BLCC SUMMARY FOR BLDG3136-DDC

	PRESENT VALUE	ANNUAL VALUE
INITIAL COST (AS OF SERVICE DATE)	$48,614	$5,728
ANNUALLY RECURRING OM&R COSTS	$10,736	$1,265
ENERGY COSTS	$77,243	$9,102
LESS: REMAINING VALUE	($0)	($0)
TOTAL LCC	$136,593	$16,095

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG3136BASE
ALTERNATIVE: BLDG3136-FMR

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 3136BASE.LCC
ALTERNATIVE LCC FILE: 3136-FMR.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG3136BASE	ALTERNATIVE: BLDG3136-FMR	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$558	-$558
SUBTOTAL	$0	$558	-$558
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$19,902	$19,902	$0
ENERGY-RELATED COSTS	$100,793	$96,794	$3,999
SUBTOTAL	$120,694	$116,695	$3,999
TOTAL P.V. LIFE-CYCLE COST	$120,694	$117,253	$3,442

NET SAVINGS FROM ALTERNATIVE BLDG3136-FMR COMPARED TO ALTERNATIVE BLDG3136BASE

Net Savings =	P.V. of non-investment savings	$3,999
-	Increased total investment	$558
	Net Savings:	$3,442

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG3136-FMR COMPARED TO ALTERNATIVE BLDG3136BASE

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 7.17$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG3136-FMR COMPARED TO ALTERNATIVE BLDG3136BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 25.55%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 2
Discounted Payback occurs in year 2

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	346,101	346,101	0	0
Central Steam	Pound	433,650	433,650	0	0

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	201.0	201.0	0.0	0.0
SOx (Kg):	1,689.2	1,689.2	0.0	0.0
NOx (Kg):	862.3	862.3	0.0	0.0
Central Steam:				
CO2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO2 (Mg):	201.0	201.0	0.0	0.0
SOx (Kg):	1,689.2	1,689.2	0.0	0.0
NOx (Kg):	862.3	862.3	0.0	0.0

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG3136BASE
ALTERNATIVE: BLDG3136-PLC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 3136BASE.LCC
ALTERNATIVE LCC FILE: 3136-PLC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG3136BASE	ALTERNATIVE: BLDG3136-PLC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$10,646	-$10,646
SUBTOTAL	$0	$10,646	-$10,646
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$19,902	$19,902	$0
ENERGY-RELATED COSTS	$100,793	$82,855	$17,938
SUBTOTAL	$120,694	$102,757	$17,938
TOTAL P.V. LIFE-CYCLE COST	$120,694	$113,403	$7,292

NET SAVINGS FROM ALTERNATIVE BLDG3136-PLC COMPARED TO ALTERNATIVE BLDG3136BASE

Net Savings	=	P.V. of non-investment savings	$17,938
	-	Increased total investment	$10,646
		Net Savings:	$7,292

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG3136-PLC COMPARED TO ALTERNATIVE BLDG3136BASE

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 1.68$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG3136-PLC COMPARED TO ALTERNATIVE BLDG3136BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = 8.62%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 6
Discounted Payback occurs in year 7

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	346,101	335,997	10,104	101,040
Central Steam	Pound	433,650	239,400	194,250	1,942,500

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO_2 (Mg):	201.0	195.2	5.9	58.7
SOx (Kg):	1,689.2	1,639.8	49.3	307.7
NOx (Kg):	862.3	837.1	25.2	251.7
Central Steam:				
CO_2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO_2 (Mg):	201.0	195.2	5.9	58.7
SOx (Kg):	1,689.2	1,639.8	49.3	307.7
NOx (Kg):	862.3	837.1	25.2	251.7

NIST BLCC: COMPARATIVE ECONOMIC ANALYSIS (version 4.20-95)

BASE CASE: BLDG3136BASE
ALTERNATIVE: BLDG3136-DDC

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 10.00 YEARS (JAN 1995 THROUGH DEC 2004)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 3136BASE.LCC
ALTERNATIVE LCC FILE: 3136-DDC.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: BLDG3136BASE	ALTERNATIVE: BLDG3136-DDC	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$48,614	-$48,614
SUBTOTAL	$0	$48,614	-$48,614
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$19,902	$10,736	$9,166
ENERGY-RELATED COSTS	$100,793	$77,243	$23,550
SUBTOTAL	$120,694	$87,979	$32,715
TOTAL P.V. LIFE-CYCLE COST	$120,694	$136,593	-$15,899

NET SAVINGS FROM ALTERNATIVE BLDG3136-DDC COMPARED TO ALTERNATIVE BLDG3136BASE

Net Savings	=	P.V. of non-investment savings	$32,715
	-	Increased total investment	$48,614
		Net Savings:	-$15,899

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE BLDG3136-DDC COMPARED TO ALTERNATIVE BLDG3136BASE

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 0.67$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE BLDG3136-DDC COMPARED TO ALTERNATIVE BLDG3136BASE
(Reinvestment rate = 3.10%; Study period = 10 years)

AIRR = -0.90%

ESTIMATED YEARS TO PAYBACK

Simple Payback never reached during study period
Discounted Payback never reached during study period

ENERGY SAVINGS SUMMARY

Energy type	Units	Annual Consumption Base Case	Annual Consumption Alternative	Annual Consumption Savings	Life-Cycle Savings
Electricity	kWh	346,101	332,211	13,890	138,900
Central Steam	Pound	433,650	228,000	205,650	2,056,500

EMISSIONS REDUCTION SUMMARY

Energy type	Annual Emissions Base Case	Annual Emissions Alternative	Annual Reduction	Life-Cycle Reduction
Electricity:				
CO2 (Mg):	201.0	193.0	8.1	80.7
SOx (Kg):	1,689.2	1,621.4	67.8	423.0
NOx (Kg):	862.3	827.7	34.6	346.1
Central Steam:				
CO2 (Kg):	0.0	0.0	0.0	0.0
SOx (Kg):	0.0	0.0	0.0	0.0
NOx (Kg):	0.0	0.0	0.0	0.0
Total:				
CO2 (Mg):	201.0	193.0	8.1	80.7
SOx (Kg):	1,689.2	1,621.4	67.8	423.0
NOx (Kg):	862.3	827.7	34.6	346.1

APPENDIX G
COST DATA

PRICING FOR FMR

			Design 5.5%		SIOH 6.0%		Total Cost
BUILDING 200	2 POINTS x $500 = $1,000	+	$55	+	$60	=	$1115
BUILDING 219	3 POINTS x $500 = $1,500	+	$82.5	+	$90	=	$1673
BUILDING 247	1 POINT x $500 = $500	+	$27.5	+	$30	=	$557.5
BUILDING 1425	1 POINT x $500 = $500	+	$27.5	+	$30	=	$557.5
BUILDING 3136	1 POINT x $500 = $500	+	$27.5	+	$30	=	$557.5

PRICING FOR PLC

BUILDING 200

Advanced Control Technologies	$12,500
TMS	$10,300
	$22,800 ÷ 2 = $11,400 Average
	$627 (Design 5.5%)
	$684 (SIOH 6.0%)
	$12,711 Total

BUILDING 219

Advanced Control Technologies	$11,500
TMS	$10,950
	$22,450 ÷ 2 = $11,225 Average
	$617 (Design 5.5%)
	$674 (SIOH 6.0%)
	$12,516 Total

BUILDING 247

Advanced Control Technologies	$13,000
TMS	$13,750
	$26750 ÷ 2 = $13,375 Average
	$736 (Design 5.5%)
	$803 (SIOH 6.0%)
	$14,914 Total

BUILDING 1425

Advanced Control Technologies	$10,400
TMS	$10,260
	$20,660 ÷ 2 = $10,330 Average
	$568 (Design 5.5%)
	$620 (SIOH 6.0%)
	$11,518 Total

BUILDING 3136

Advanced Control Technologies	$9,100
TMS	$9,995
	$19,095 ÷ 2 = $9,548 Average
	$525 (Design)
	$573 (SIOH)
	$10,646 Total

Ft. Belvoir EMS Study
EMS Cost Estimate - Advanced Control Technologies

BUILDING 200	25 POINTS x $500	$12,500
BUILDING 219	23 POINTS x $500	$11,500
BUILDING 247	36 POINTS x $500	$13,000
BUILDING 1425	16 POINTS x $500	$10,400
BUILDING 3136	14 POINTS x $500	$9,100

POWER DYNAMICS CORPORATION
LARGO PARK SUITE 152
1300 MERCANTILE LANE LANDOVER, MD 20785
(301) 773-0500 FAX (301) 300-2040

January 13, 1995

Mr. Dave Smith
Einhorn, Yaffee, Prescott
The Flour Mill
1000 Potomac Street, NW
Washington, DC 20007-3238

Re: Fort Belvoir, Virginia
Energy Management Study

Dear Mr. Smith:

Thank you for your recent interest in our products and services. Please find enclosed a general proposal overview that can be used for each of the five (5) buildings. We have also enclosed budgeting for each building based on the information you provided us.

Please review and respond with any questions you may have. We hope all the information provided will be of benefit. We have represented the TMS/Facilitec Equipment for over seven (7) years and have been in the EMS business since 1976.

Regards,

Donald G. Bacon

Donald G. Dacon

DGB/slp
Enclosure(s)

POWER DYNAMICS CORPORATION
LARGO PARK SUITE 152
1300 MERCANTILE LANE LANDOVER, MD 20785
(301) 773-0500 FAX (301) 386-2646

January 13, 1995

TO: Mr. Dave Smith
Einhorn, Yaffee, Prescott

RE: Fort Belvoir, Virginia / EMS Study
Proposal Overview

The following is a description of what each building proposal will include.

A. One (1) TMS 500 programmable stand alone DDC controller with LCD screen display, PC Type keyboard, flash ram back-up card and telephone communication 9600 Baud Data Modom.

B. X # of RTU-1000 Unitary Input/Output point controllers. Each RTU has six (6) point capability.

C. Connection of the RTU-1000 Digital outputs to the carrier current command module (supplied by others) input terminals. Note: Pricing is based on wire to carrier current device located within 20 feet of the RTU 1000 mounting location and being in the same physical room.

D. Programming of the TMS 500 for scheduled control of the DDC outputs to the carrier current device.

E. One (1) year full labor and parts warranty on all equipment provided by PDC from start-up.

F. Initial check-out, system start-up and training for all PDC supplied equipment.

Notes:

1. All needed dedicated phone line(s) for remote communications to be provided by others.

2. All pricing shown is for budgeting purposes only, and is based on information provided and similar type application history. We will provide concise pricing per request, and only after individual building walk-through.

POWER DYNAMICS CORPORATION
LARCO PARK SUITE 152
1300 MERCANTILE LANE LANDOVER, MD 20785
(301) 773-0500 FAX (301) 386-2646

January 13, 1995

TO: Mr. David Smith
Einhorn, Yaffee, Prescott

RE: Fort Belvoir, Virginia / EMS Study
Individual Building Budgeting

1. Building 200 — $ 10,300.00

   Three (3) RTU -1000's
   Seventeen (17) points

2. Building 219 — $ 10,950.00

   Four (4) RTU-1000's
   Twenty-three (23) points

3. Building 247 — $ 13,740.00

   Seven (7) RTU-1000's
   Thirty-eight (38) points

4. Building 1425 — $ 10,260.00

   Three (3) RTU - 1000's
   Sixteen (16) points

5. Building (No #) — $ 9,995.00

   Three (3) RTU - 1000's
   Fourteen (14) points

Notes:

1. All buildings looked at separately regarding carrier current.
2. Each building will have basic programmable control.
3. We have combined four (4) fan coil units to one (1) point.
4. Each building has separate control capabilities via provided TMS-500.
5. More detail, building by building, provided per request.
6. If all buildings are done at once, please allow 4 to 6% discount for budgeting purposes.
7. Utility usage reduction / savings analysis available per request.
8. All information provided for budgeting purposes only.

PRICING FOR DDC

<u>BUILDING 200</u>

Johnson Controls	$60,000	
Honeyewell	$89,600	
Andover	<u>$62,320</u>	
	$211,920 ÷ 3 =	$70,640 Average
		$3,885 (Design 5.5%)
		<u>$4,238</u> (SIOH 6.0%)
		$78,76~~4~~ Total
		3

<u>BUILDING 219</u>

Johnson Controls	$64,000	
Honeywell	$65,400	
Andover	<u>$113,980*</u>	
	$129,400 ÷ 2 =	$64,700 Average
		$3,559 (Design 5.5%)
		<u>$3,882</u> (SIOH 6.0%)
		$72,141Total

<u>BUILDING 247</u>

Johnson Controls	$79,800	
Honeywell	$77,000	
Andover	<u>$329,940*</u>	
	$156,800 ÷ 2 =	$78,400 Average
		$4,312 (Design 5.5%)
		<u>$4,704</u> (SIOH 6.0%)
		$87,416 Total

<u>BUILDING 1425</u>

Johnson Controls	$48,280	
Honeywell	$39,600	
Andover	<u>$99,200*</u>	
	$87,880 ÷ 2 =	$43,940 Average
		$2,417 (Design 5.5%)
		<u>$2,636</u> (SIOH 6.0%)
		$48,993 Total

<u>BUILDING 3136</u>

Johnson Controls	$46,100	
Honeywell	$34,700	
Andover	<u>$50,000</u>	
	$130,800 ÷ 3 =	$43,600 Average
		$2,398 (Design 5.5%)
		<u>$2,616</u> (SIOH 6.0%)
		$48,614 Total

* value not used in averaging because of excessive disparity from other values

ESTIMATED ANNUAL MAINTENANCE COSTS FOR EXISTING PNEUMATIC SYSTEMS

BUILDING 200

	Material		Labor
3 - Constant Volume Single Zone AHUs	$1,500		$1,560
2 - Constant Volume Multi-Zone AHUs	$1,300		$1,560
1 - 100% Outside AHU	$200		$260
1 - Chiller	$200		$260
5 - Pumps	$250		$325
1 - ATC Compressor	$200		$520
1 - Refrigerated Air Dryer	$100		$260
	$3,750	+	$4,745 = **$8,495 Total**

BUILDING 219

	Material		Labor
1 - Constant Volume Single Zone AHU	$500		$520
2 - Constant Volume Built-Up AHU	$700		$1,040
1 - Hot Water Convertor	$300		$520
1 - Change-Over System	$100		$65
3 - Pumps	$150		$195
2 - Chillers	$400		$520
1 - ATC Compressor	$200		$520
1 - Refrigerated Air Dryer	$100		$260
	$2,450	+	$3,640 = **$6,090 Total**

BUILDING 247

	Material		Labor
1 - Built-Up Penthouse AHUs	$500		$1,040
20-Constant Volume AHUs	$5,000		$5,200
1 - Centrifugal Chiller and Tower	$700		$260
9 - Pumps	$450		$585
1 - ATC Compressor	$200		$520
1 - Refrigerated Air Dryer	$100		$260
	$6,950	+	$7,865 = **$14,815 Total**

BUILDING 1425

	Material	Labor	
52-Fan Coil Units	$780	$1,690	
1 - Hot Water Convertor	$150	$260	
1 - Chiller	$200	$260	
1 - Changer-Over System	$100	$65	
3 - Pumps	$150	$195	
1 - ATC Compressor	$200	$520	
1 - Refrigerated Air Dryer	$100	$260	
	$1,680 +	$3,250 =	**$4,930 Total**

BUILDING 3136

	Material	Labor	
1 - Hot Water Convertor	$150	$260	
1 - Chiller	$200	$260	
1 - Changer-Over System	$100	$65	
2 - Pumps	$100	$130	
1 - ATC Compressor	$200	$520	
1 - Refrigerated Air Dryer	$100	$260	
	$850 +	$1,495 =	**$2,345 Total**

ESTIMATED ANNUAL MAINTENANCE COSTS FOR NEW DDC SYSTEMS

BUILDING 200

	Material		Labor
3 - Constant Volume Single Zone AHUs	$300		$780
2 - Constant Volume Multi-Zone AHUs	$300		$520
1 - 100% Outside AHU	$100		$130
1 - Chiller	$100		$130
5 - Pumps	$250		$325
	$1,050	+	$1,885 = **$2,935 Total**

BUILDING 219

	Material		Labor
1 - Constant Volume Single Zone AHU	$100		$260
2 - Constant Volume Built-Up AHU	$200		$390
1 - Hot Water Convertor	$300		$390
1 - Change-Over System	$100		$65
3 - Pumps	$150		$195
2 - Chillers	$100		$130
	$950	+	$1,430 = **$2,380 Total**

BUILDING 247

	Material		Labor
1 - Built-Up Penthouse AHUs	$300		$520
20-Constant Volume AHUs	$5,000		$5,200
1 - Centrifugal Chiller and Tower	$200		$260
9 - Pumps	$450		$585
	$5,950	+	$6,565 = **$12,515 Total**

BUILDING 1425

	Material		Labor	
52-Fan Coil Units	$780		$1,690	
1 - Hot Water Convertor	$150		$260	
1 - Chiller	$150		$130	
1 - Changer-Over System	$100		$65	
3 - Pumps	$150		$195	
	$1,330	+	$2,340	= **$3,670 Total**

BUILDING 3136

	Material		Labor	
1 - Hot Water Convertor	$150		$260	
1 - Chiller	$200		$260	
1 - Changer-Over System	$100		$65	
2 - Pumps	$100		$130	
	$550	+	$715	= **$1,265 Total**

Johnson Controls, Inc.
Systems and Services Division
5740 General Washington Drive
Post Office Box 11248
Alexandria, VA 22312
Tel. 703/750 3250

JOHNSON CONTROLS

EYP
Attn: Mr. Dave Smith
1000 Potomac St. L1 NW
Washington, DC 20007

December 17, 1993

Ref: Fort Belvoir Building Automation

Dear Dave:

This letter is in reference to the pricing information that you requested for buildings 200, 219, 247, 1425 and 3136 at Fort Belvoir.

After our site visit on 12/10/93, Julio and I created the following unit pricing scenario to assist you in writing your final study for the Baltimore Corp. of Engineers. The pricing was broken out by systems which were surveyed along with the necessary components to connect each building into one network. The pricing breakouts are as follows:

System	**Price**
Boiler Control	$ 4,600.00
Chiller Control	$ 5,200.00
Air Handling Unit	$ 5,900.00

Additional Components

Network Control Unit (1 slot)	$10,000.00
Ethernet Router	$ 6,000.00
Operator Workstation	$25,000.00

Please refer to the attached point schedules to see the system points.

Please feel free to contact me at any time with any questions that you may have pertaining to this project.

Sincerely,
Johnson Controls, Inc.

Thomas J. George
Account Manager

G-12

Johnson Controls METASYS Facilities Management System Point Schedule

System Name: AHU Control   System Type: AHU Controller   Date: 12/17/93

		Hardware				Output Features					Software Features							
Point Number	Point Description	Analog Input	Analog Output	Binary Input	Binary Output	B.O. On/Off/Auto Switch	A.O. Manual Override	A.O. Override Status	B.O. Override Status	Pneumatic Output	Time Scheduling	Point Graphic	Analog History (24 hrs)	Binary History (10 Changes of State)	PID Loop Control		Total Points	Comments:
1	AHU Start/Stop				x	x			x		x	x		x				
2	AHU Status			x								x		x				
3	Supply Air Temperature	x										x	x					
4	Return Air Temperature	x										x	x					
5	Mixed Air Temperature	x										x	x					
6	Outdoor Air Temperature	x										x	x					
7	Outdoor Air Damper Control		x									x	x		x			
8	Chilled Water Valve Control		x									x	x		x			
9	Hot Water Valve Control		x									x	x		x			
10																		
11																		
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28																		
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30																		
31																		
32																		
	Number of Points	4	3	1	1												9	

Johnson Controls METASYS Facilities Ma... ...ement System Point Schedule

...em Name: Chiller Control **System Type: I... Controller** **Date: 12/17/93**

Point Number	Point Description	Hardware: Analog Input	Hardware: Analog Output	Hardware: Binary Input	Hardware: Binary Output	Output Features: B.O. On/Off/Auto Switch	Output Features: A.O. Manual Override	Output Features: A.O. Override Status	Output Features: B.O. Override Status	Output Features: Pneumatic Output	Software Features: Time Scheduling	Software Features: Point Graphic	Software Features: Analog History (24 hrs)	Software Features: Binary History (10 Changes of State)	Software Features: PID Loop Control		Total Points	Comments:
1	Chiller Start/Stop				x	x			x		x	x		x				
2	Chiller Status			x								x		x				
4	Chilled Water Supply Temperature	x										x	x		x			
5	Chilled Water Return Temperature	x			x							x	x		x			
6	Condenser Water Supply Temperature	x										x	x		x			
7	Condenser Water Return Temperature	x										x	x		x			
8	Chiller Pump Start/Stop				x	x			x		x	x		x				
9	Chiller Pump Status			x								x		x				
10																		
11																		
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31																		
32																		
	Number of Points	4		2	2												8	

Johnson Controls METASYS Facilities Ma ment System Point Schedule

ystem Name: Boiler Control System Type: L Controller Date: 12/17/93

Point Number	Point Description	Hardware: Analog Input	Analog Output	Binary Input	Binary Output	Output Features: B.O. On/Off/Auto Switch	A.O. Manual Override	A.O. Override Status	B.O. Override Status	Pneumatic Output	Software Features: Time Scheduling	Point Graphic	Analog History (24 hrs)	Binary History (10 Changes of State)	PID Loop Control		Total Points	Comments:
1	Boiler Start/Stop				x	x			x		x	x		x				
2	Boiler Status			x								x		x				
3	Flame Failure	x										x		x				
4	Hot Water Supply Temperature	x										x	x		x			
5	Hot Water Return Temperature				x							x	x		x			
6	Boiler Pump Start/Stop			x		x			x		x	x		x				
7	Boiler Pump Status											x		x				
8																		
9																		
10																		
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32																		
	Number of Points	2		3	2												7	

Facsimile Cover Sheet

To: DAVID L SMITH PE
Company: EINHORN YAFFEE PRESCOTT
Phone: 202/471-5082
Fax: 202/471-5050

From: RICHARD N. PRIDGEON
Company: HONEYWELL, INC.
Phone: (703)749-2072
Fax: (703)749-2093

Date: 07/07/94
Pages Including this cover page: 4

Comments:

DAVID,

SORRY FOR THE DELAY IN GETTING THIS INFORMATION TO YOU. PLEASE CALL WITH ANY QUESTIONS. I WILL FOLLOW UP WITH INFO ON ESUSA AND LON WORKS

THANK YOU

RNP

G-16

Honeywell

Honeywell Inc.
1766 Old Meadow Ln
McLean VA 22102-4387

July 7, 1994

Mr. David L. Smith, P.E.
Einhorn Yaffee Prescott
The Flour Mill
1000 Potomac Street, NW
Washington, DC 20007

Ref.: Fort Belvior
Energy Management System - Budget Pricing

Dear David:

As requested, attached please find a detailed budget cost breakdown for providing and installing a Direct Digital Control Energy Management System per your control points list for the following buildings located at Fort Belvior, Virginia:

-BLDG. 200
-BLDG. 219
-BLDG. 247
-BLDG. 1425
-BLDG. 3136

These cost figures are based on a turnkey installation of a state of the art Direct Digital Control System consisting of the following qualifications:

• All major pieces of mechanical equipment (i.e. AHU, Chillers, Boilers, Hot Water Converters etc.) will be controlled by a stand alone master DDC panel with a real time clock, non-volatile memory, communication hardware/software and the ability to operate all energy management routines and control loop logic without any additional panels or Host processors.

-All unitary or terminal mechanical equipment(Fan Coil Units) will be controlled by stand alone slave DDC panels which require communication with a master DDC panel for real time clock functions but can function in a "degraded" mode upon loss of communication with the master.

-The cost of a Graphic Operators Workstation(location to be determined) including all data file generation, parameters and graphic creation has been included

-All electrical work will be performed per the National Electric Code with all work in mechanical rooms(low and line voltage) to be installed in EMT conduit as a minimum.

Mr. David L. Smith, P.E.
July 7, 1994
Page - 2

-All pneumatic tubing will be hard copper if exposed and soft copper if concealed yet accessible if part of a smoke control system. All other exposed pneumatic tubing will be plastic run in EMT conduit.

-The attached cost figures include complete AUTO CAD REV 12 submittal drawings with the following:

- -Riser diagrams
- -Flow diagrams
- -Point to point wiring diagrams with wire lists
- -Software logic ladder diagrams
- -Installation details
- -As-built drawings

-Also included in these costs are O&M Manuals, Programmers Manuals, Operators Guide etc.

-Four(4) training sessions (on site) at eight(8) hours each are included for classes up to six operators.

-All work and material installed will be guaranteed to operate as designed for a period of one(1) year after owner acceptance.

I hope this information is sufficient for your needs, if you have any questions please feel free to contact me at 703/749-2072.

Sincerely,

Richard N. Pridgeon

RICHARD N. PRIDGEON, JR.
SENIOR SALES ENGINEER
703/749-2072

FORT BELVIOR ENERGY MANAGEMENT SYSTEM
BUDGETARY PRICING - JULY 1994

BUILDING	MECHANICAL EQUIPMENT	COST/EA.	QTY	TOTAL		
BLDG. 200						
	SINGLE ZONE AHU	11,200.00	3	33,600.00		
	MULTIZONE AHU(3 ZONES)	15,200.00	1	15,200.00		
	MULTIZONE AHU(7 ZONES)	18,400.00	1	18,400.00		
	SINGLE ZONE- 100% OA	8,000.00	1	8,000.00		
	CHILLER(2 STAGE)	6,400.00	1	6,400.00		
	BOILER	8,000.00	1	8,000.00		
		SUBTOTAL			89,600.00	
BLDG. 219						
	AHU 1B	10,400.00	1	10,400.00		
	AHU 1A	11,200.00	1	11,200.00		
	FAN COIL UNITS	500.00	38	19,000.00		
	BOILERS	3,200.00	2	6,400.00		
	HOT WATER CONVERTOR	4,000.00	2	8,000.00		
	PAKAGED CHILLER	3,200.00	1	3,200.00		
	SPLIT AIR COOLED CHILLER	3,200.00	1	3,200.00		
	DUAL TEMP WATER LOOP	4,000.00	1	4,000.00		
		SUBTOTAL			65,400.00	
BLDG. 247						
	~~CONSTANT VOLUME AHU~~	~~8,000.00~~	~~20~~	~~160,000.00~~	DELETE	
	AUDITORIUM AHU	8,800.00	1	8,800.00		
	FAN COIL UNITS	500.00	93	46,500.00		
	BOILERS	4,800.00	2	9,600.00		
	CHILLER(CENTRIFICAL)	12,800.00	1	12,800.00		
		SUBTOTAL			~~237,700.00~~	77,700
BLDG. 1425						
	FAN COIL UNITS	500.00	52	26,000.00		
	CHILLER	3,200.00	1	3,200.00		
	HOT WATER CONVERTOR	4,000.00	1	4,000.00		
	DUAL TEMP WATER LOOP	6,400.00	1	6,400.00		
		SUBTOTAL			39,600.00	
BLDG. 3136						
	FAN COIL UNIT	500.00	47	23500.00 ~~12,500.00~~	MATH ERROR	
	HOT WATER CONVERTOR	3,200.00	1	3,200.00		
	CHILLER	3,200.00	1	3,200.00		
	DUAL TEMP. WATER LOOP	4,800.00	1	4,800.00		
		SUBTOTAL			~~23,700.00~~ 34,700.00	
		GRAND TOTAL			456,700.00	

CES

FAX TRANSMISSION

TO: ATTENTION: David Smith

FIRM: Einhorn Yaffee Prescott

FAX NUMBER: (202) 471-5050

FROM: NAME: Jim Wilson

PHONE NUMBER: (703)354-3331

DATE: 7/12/94

TIME: 2:44

SUBJECT: Ft. Belvoir EMS

Number of pages being sent : 2
(including this cover sheet)

Hard copy to follow in mail: Yes ✓ No____

NOTES:

Washington Gas Energy Systems, Inc.
5500 Cherokee Avenue, Suite 310, Alexandria, VA 22312 • (703) 354-3331 • fax (703) 941-8969

CES

July 12, 1994

Mr. David Smith
Einhorn Yaffee Prescott
The Flour Mill
1000 Potomac Street NW
Washington, DC 20007-3238

RE: Ft. Belvoir Energy Management - Project No. 60692.80

Dear Mr. Smith:

Washington Gas Energy Systems, Inc. is pleased to provide budget pricing on providing an Andover System for the following buildings located at Fort Belvoir, Virginia, per your points list dated 12/20/93:

Building 200	$ 62,320.00
Building 219	$113,980.00
Building 1425	$ 99,220.00
Building 3136	$ 50,020.00
Building 247	$329,940.00

If you should have any questions regarding the above pricing, please do not hesitate to contact me at (703) 354-3331.

Sincerely,

WASHINGTON GAS ENERGY SYSTEMS, INC.

James C. Wilson
Automation Specialist

JCW/as

G-21

Ft. Belvoir EMS Study
EMS Cost Estimates - Johnson Controls

Bldg 200

Component	Units	Quantity	Unit Cost	Extended Cost
Building EMS Controller	Each	1	$10,000	$10,000
Multizone Air Handling Units	Each	2	$6,500	$13,000
Single Zone Air Handling Units	Each	4	$5,900	$23,600
Fan Coil Units	Each	0	$560	$0
Exhaust Fans	Each	4	$560	$2,240
Boilers	Each	1	$5,200	$5,200
Chillers	Each	1	$4,600	$4,600
Hot Water Convertors	Each	0	$4,000	$0
			Total	$58,640

Bldg 219

Component	Units	Quantity	Unit Cost	Extended Cost
Building EMS Controller	Each	1	$10,000	$10,000
Multizone Air Handling Units	Each	0	$6,500	$0
Single Zone Air Handling Units	Each	2	$5,900	$11,800
Fan Coil Units	Each	38	$560	$21,280
Exhaust Fans	Each	2	$560	$1,120
Boilers	Each	2	$5,200	$10,400
Chillers	Each	2	$4,600	$9,200
Hot Water Convertors	Each	0	$4,000	$0
			Total	$63,800

Bldg 247

Component	Units	Quantity	Unit Cost	Extended Cost
Building EMS Controller	Each	1	$10,000	$10,000
Multizone Air Handling Units	Each	0	$6,500	$0
Fan Coil Units	Each	93	$560	$52,080
Exhaust Fans	Each	5	$560	$2,800
Boilers	Each	2	$5,200	$10,400
Chillers	Each	1	$4,600	$4,600
Hot Water Convertors	Each	0	$4,000	$0
			Total	$79,880

Bldg 1425

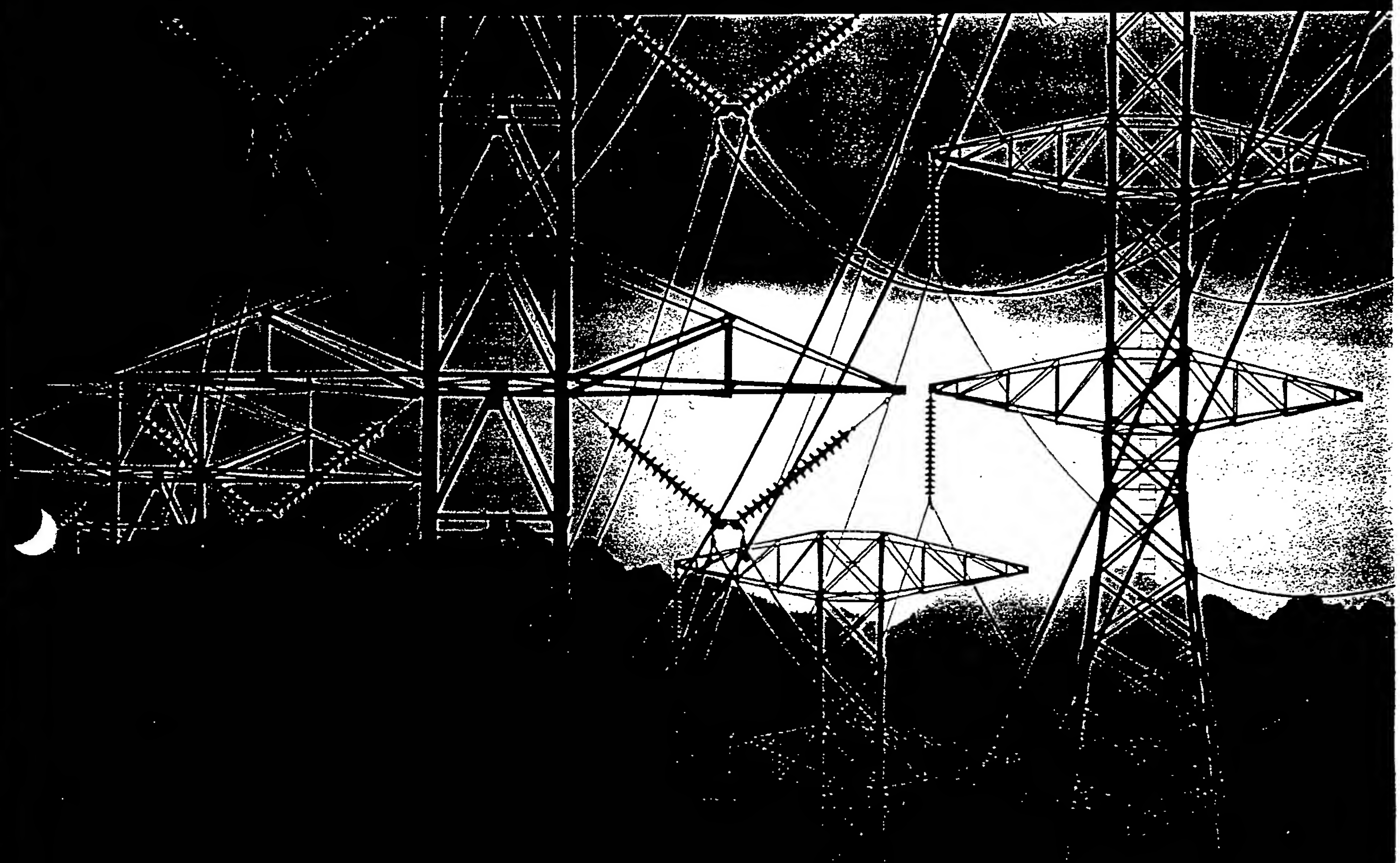
Component	Units	Quantity	Unit Cost	Extended Cost
Building EMS Controller	Each	1	$10,000	$10,000
Multizone Air Handling Units	Each	0	$6,500	$0
Single Zone Air Handling Units	Each	0	$5,900	$0
Fan Coil Units	Each	52	$560	$29,120
Exhaust Fans	Each	1	$560	$560
Boilers	Each	0	$5,200	$0
Chillers	Each	1	$4,600	$4,600
Hot Water Convertors	Each	1	$4,000	$4,000
			Total	$48,280

Bldg 3136

Component	Units	Quantity	Unit Cost	Extended Cost
Building EMS Controller	Each	1	$10,000	$10,000
Multizone Air Handling Units	Each	0	$6,500	$0
Single Zone Air Handling Units	Each	0	$5,900	$0
Fan Coil Units	Each	47	$560	$26,320
Exhaust Fans	Each	2	$560	$1,120
Boilers	Each	0	$5,200	$0
Chillers	Each	1	$4,600	$4,600
Hot Water Convertors	Each	1	$4,000	$4,000
			Total	$46,040

APPENDIX H
EQUIPMENT CUT SHEETS

FMS



Scientific
Atlanta
Control Systems Division

H-2

Load management: a profitable proposition.

Load management is an effective means of improving your utility's operating efficiency and reducing utility operating costs by controlling deferrable loads with radio.

Control of deferrable loads such as air conditioners, water heaters, heat pumps and irrigation pumps is the first tool to implement in a demand side management program. Whether you are a reseller of electric power or a power generating utility, demand side management offers a number of advantages to you and your customers.

Advantages For Power Generators

- Lowers capacity requirements, including transmission and substation needs
- Relieve regulatory and societal pressures caused by new power plant construction
- Provides another option in economic dispatch decision
- Improves customer relations

Advantages For Power Buyers

- Reduces demand charges or cost of power
- Improves load factor
- Lowers substation and distribution capacity requirements
- Improves customer relations

The Load Management System

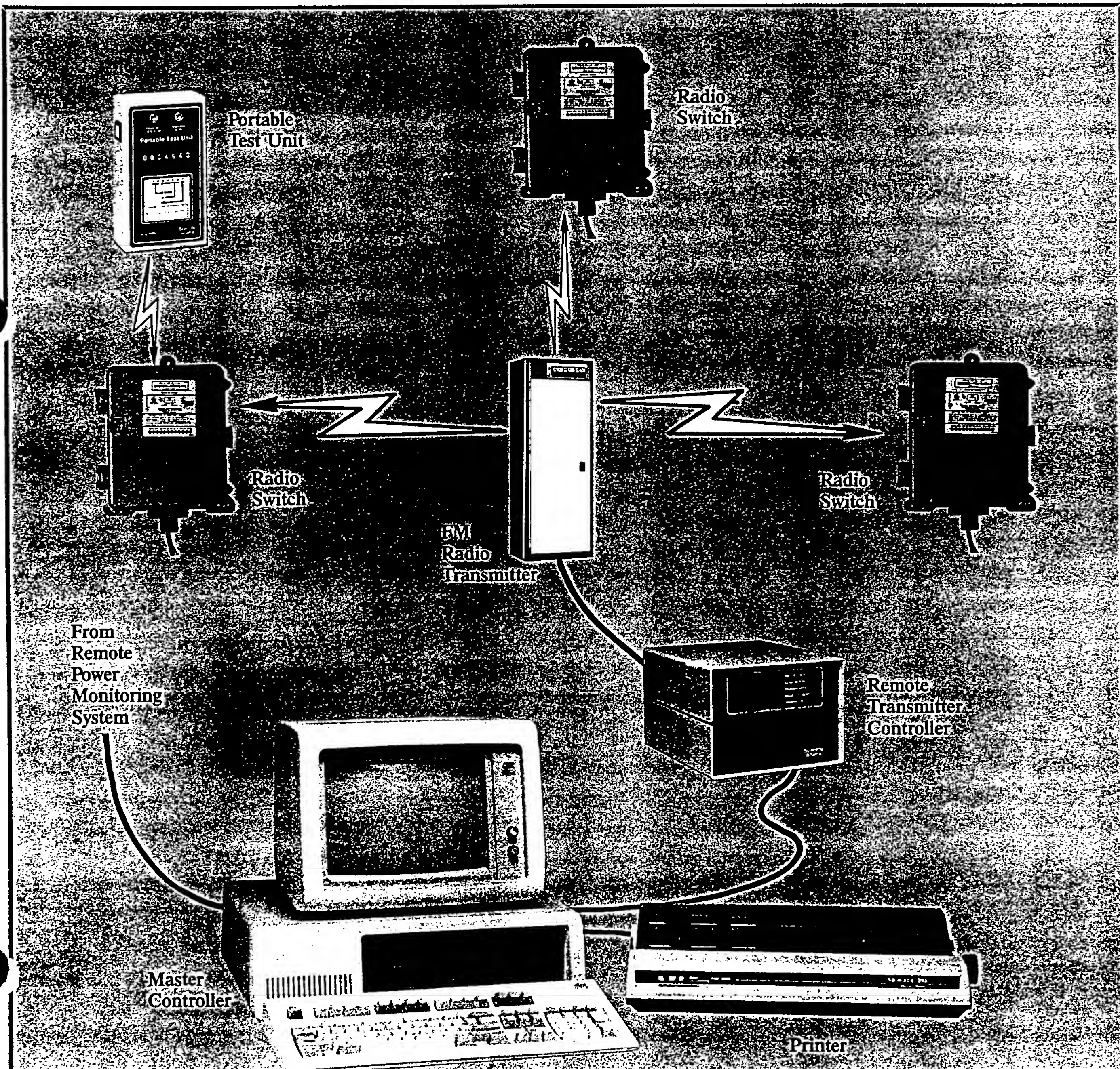
Scientific-Atlanta's Load Management System consists of:

Radio controlled switches to control the deferrable loads at residences and businesses.

Communications which include the standard VHF transmitters and interface devices.

The Master Controller where the control strategies are defined and commands are issued to the radio transmitter.

Test equipment to verify system operation.



H-4

Radio Controlled Switches

The on-premise switch is the most important part of the load management system. Signals transmitted by the radio under the direction of the system Master Controller are received by the switch. The received signal causes the switch to disconnect one or more high consumption, deferrable loads. Typical loads include air conditioners and hot water heaters. Load disconnect is accomplished by relays inside the switch. Scientific-Atlanta offers switches for Scientific-Atlanta, Motorola Golay 23, 12 (Digital), and General Electric 100, 101, 102 and S-A 105 coding formats.

Each switch can have up to four relays and/or relay drivers depending on the coding format. These are available in certain combinations of 5 or 30 amp capacity. The relays respond individually to transmitted digital codes—allowing separate control strategies for each load connected to the switch.

LOAD SHEDDING

The load shed sequence starts when the system Master Controller sends a digitally coded signal to the remote transmitter controller and the radio transmitter. The digital coding allows the system to activate specific groups of switches. Transmitting different digital codes activates different groups of switches.

When the switch receives the coded signal, it compares it to the address programmed into its memory. If the code is correct for one of the switch's relays, the appropriate relay will open, dropping the connected load from the utility system.

RESTORING THE LOAD

When the relay in the switch opens, shedding the load, the microprocessor in the switch starts a timer. The timer can be programmed for time-outs of 7.5, 15, 30 or 60 minutes. The actual time-out of the switch varies by plus or minus 1.5 minutes, assuring that not all the disconnected appliances will come back on-line at the same time. The time-out variable for each switch changes each time it is disconnected. This means that, on average, no one consumer is disconnected longer than another. At the end of the time-out period, the relay closes and the load is restored.

If a longer switch time-out is desired, a "refresh" message can be sent to those switches which have their relays open. This "refresh" message resets the timer to zero and starts the countdown again. This enables the utility to keep a switch with a 7.5 minute time-out off for several hours, if desired. Air conditioners are typically controlled 7.5 minutes out of every 30 minutes durng the time of expected peak. Water heaters can be turned off entirely for 2 to 4 hours during the peak.

AFTER A POWER OUTAGE

Each switch also has the ability to disconnect its load immediately after a power outage. This "cold load pick-up" feature is selectable to aid the system when it has been down for an extended period and the system has lost its natural diversity. If the "cold load pick-up" feature is selected, the switch will be off for one time-out period (7.5, 15, 30, or 60 minutes) following the power restoration.

TESTING THE SYSTEM

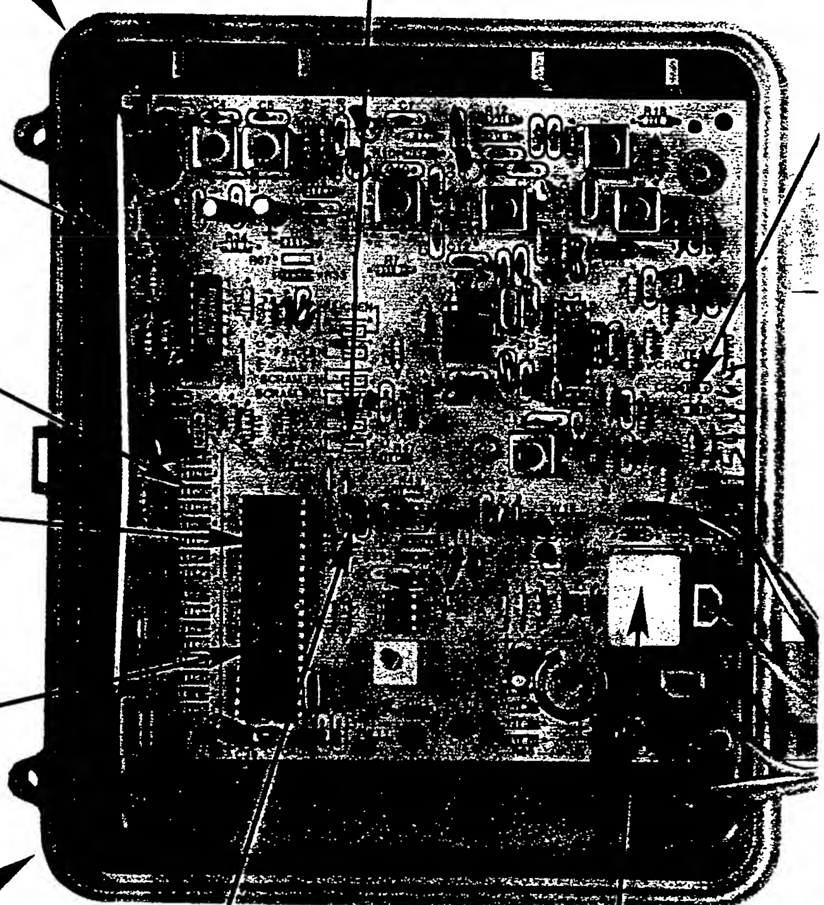
The switch also has the capability of storing a record of the activity in memory. It logs the number of activations of each relay, the number of test messages received, and the period of time since the counters were reset. This information is recalled from the microprocessor memory by using a Portable Counter Display (PCD). The PCD uses an internally generated radio transmission and optical coupling to access the stored information, eliminating the need to open the enclosure. Comparing the number of activations read from the switch to the control system history verifies that the system is operating correctly.

IN CASE OF EMERGENCY

The switch also has the ability to disconnect all of its loads when a special "SCRAM" code is received. All Scientific-Atlanta switches have the capability to respond to one emergency code. The number of "SCRAM" codes available varies with the switch format.

H-5

Radio Controlled Switch Features.



Polycarbonate enclosure

Time-out selectable in the field 7.5, 15, 30, or 60 minutes ±1.5 minutes (randomized)

Omnidirectional antenna

"Pin and Cap" programming available—separate digital addresses for each function

Microprocessor controls 1 to 4 functions (depending on format) and stores activity in its memory

Microprocessor capable of decoding several formats (factory selectable)

Electronics mounted in snap-off door for easy field maintenance

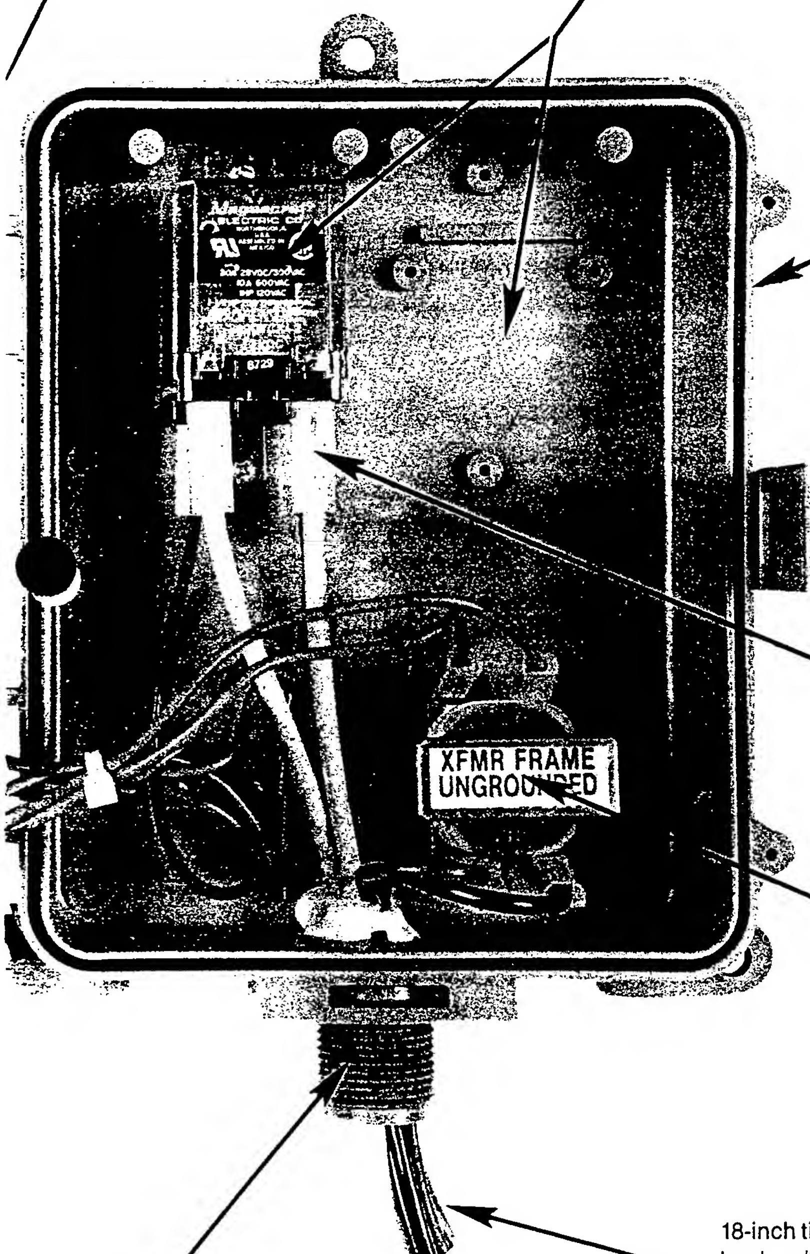
"Watchdog" circuitry monitors the microprocessor and automatically restarts program if disrupted by electrical disturbance

5 amp form C relay mounted on board

Options:

- 5-amp relay (1-3)
- 30-amp relay (1 or 2)
- External Antenna
- Alternate voltages
- Test LED
- Function LED's
- Two-piece elbow
- Mechanically latched relays for distribution automation control

H-6


Optional test and function LEDs can be seen through window in the front
Positions for one or two 30-amp or 5-amp relays (form B)
Weatherproof gasket for indoor or outdoor installation
Enclosure clasp keeps door tightly shut (can be meter sealed)
Quick disconnects on all leads
XFMR FRAME
UNGROUNDED
Alternate supply voltages available
18-inch tinned copper leads—#12 AWG for power and 30 amp relays; #18 AWG for 5 amp relays and relay drivers (to remote relays)
3/4" nipple (two-piece 90° elbow optional)

Master Controller

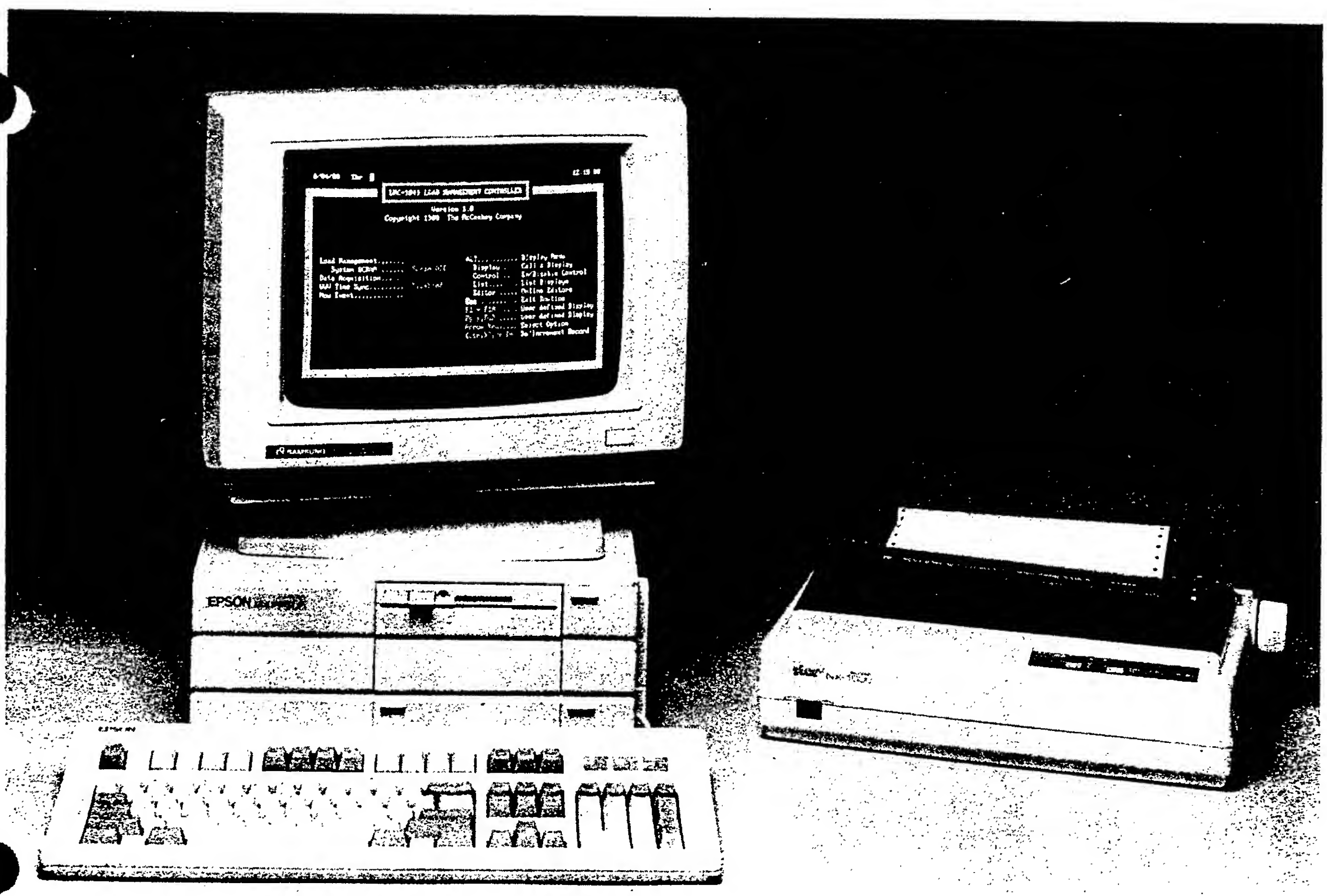
Scientific-Atlanta's load management controllers are microprocessor based computers which provide centralized control of a utility's load management system. The controllers are used to implement strategies which allow a utility to accomplish its load management goals.

The load management controller contains operating programs which monitor the system load, calculate load shedding schedules, and send out digital messages to cause the desired load shed to take place. Configuration information, which defines the utility's system, is typed into the computer. This information includes characteristics or data coming from a substation or SCADA system, load control receiver grouping information, control strategies, and receiver addresses.

Once the configuration data is entered, the master controller processes it in accordance with built-in programs that instruct the computer on how to do its job. These built-in programs are stored in Read Only Memory which is permanent and not lost if power is removed.

After digesting the configuration data, the master controller will know what messages it must provide and when to schedule messages.

Model LMC-1041



H-8

Typical Load Management Program

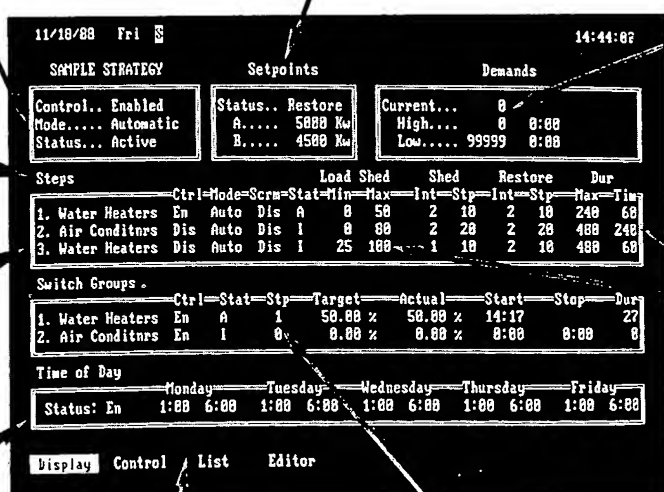
This screen was "built" by the user from standard information to display the most important information on a real-time basis.

Control: Can be enabled or disabled from this page.
Mode: Allows automatic or manual operation
Status: Shows whether control is active or inactive.

Status: Indicates direction of the program (shedding or restoring).
A: The demand level at which load control is initiated.
B: The demand level at which the program starts restoring the loads.

Current: Total system demand.
High: The high demand (with time) for the current period.
Low: The low demand for the current period.

Steps: Define the order of the procedure for controlling load.



Duration: The maximum and current duration of this step being active.

Names: The type of load controlled in each step.

Load Shed—Min and Max: Sets the limits of load shed percentage for this step.

Time of Day: Shows which days and what time of day this strategy can be active (subject to other setpoint demands and/or contact closures).

Step: Describes in which step this switch group is currently being used.

Main Menu: This can be displayed on any page in the run mode by hitting the (ALT) key.

VHF Radio Communications

Licensing

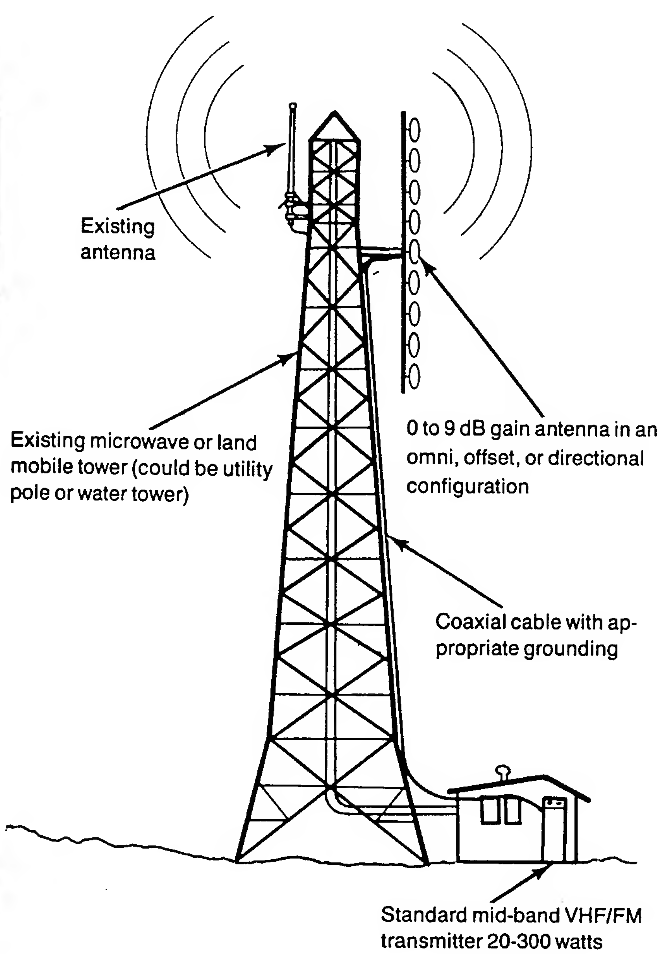
The licensing process for a load management transmitter is the same for a utility as it is for a land mobile transmitter.

An application is made to the Utilities Telecommunication Council (UTC) for a frequency. After a study of surrounding users, the UTC then issues an authorization for the designated load management frequency of 154.46375 Megahertz or one in the 173.XXX MHz range.

Next, the utility prepares an application to the Federal Communications Commission for a license to operate. Since coordination with other users has been done by the UTC, the FCC approves these applications with little trouble.

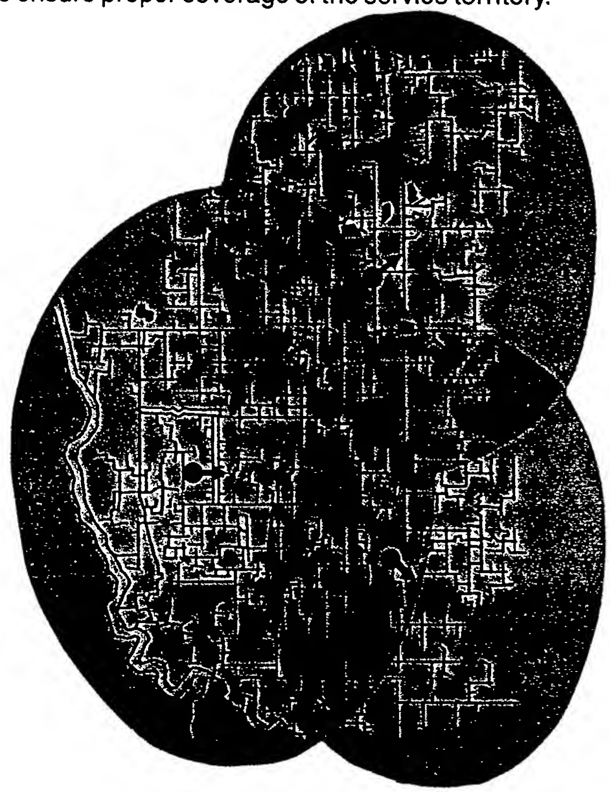
After obtaining the license, the utility then can install and operate its transmitters.

VHF Radio Equipment



Propagation Studies.

A propagation study is conducted by Scientific-Atlanta to ensure proper coverage of the service territory.



Radio System Maintenance

The radio transmitters used in a Scientific-Atlanta load management system are the same VHF/FM transmitters that a utility uses for its two-way mobile communications. The use of a standard transmitter provides the utility with the benefit of being able to install, test, align and maintain the load management transmitters in the same manner as they manage their land mobile network.

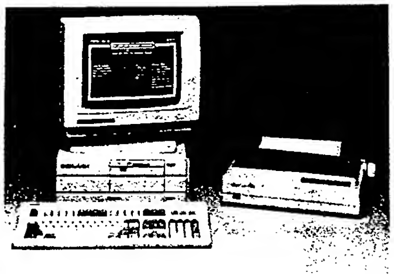
H-10

Consumer Promotions

H-11

Scientific-Atlanta Load Management Products

LMC-1041 Load Management Controller and Data Acquisition System



The LMC-1041 is a programmable PC compatible based controller running on MS-DOS with extensive provisions for automatically gathering substation data and controlling load management functions, capacitor switching, voltage regulator control and/or other remote switching functions. The software design of the LMC-1041 allows it to act as a separate data acquisition system, as a separate load management controller, or both.

Manual or automatic operation is permitted for each separate control group. Any number of addresses can be assigned to each group.

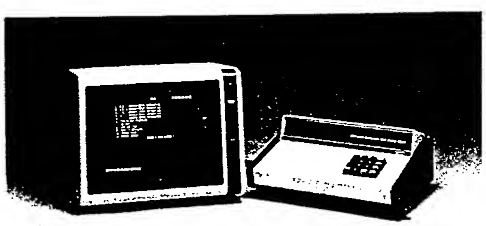
The user can control points with different strategies, by time- of-day and/or by set points using and/or conditionals. The information from contact closures (status), pulse or analog inputs can be used to calculate values. These values and groups of values are then used in the decision making process.

The LMC-1041 interfaces with Scientific-Atlanta's Remote Transmitter Controllers and Store-and-Forward repeaters to control the transmitter network required to cover the utility's service area.

Features:

- User friendly software, but flexible and large enough to fit all load control needs.
- Any number of addresses, control groups, strategies allowed. Limited only by memory.
- Combines data acquisition and load control into one machine.
- Operating characteristics can be modified while program runs.

MGU-1008 Mini-Message Generator Unit

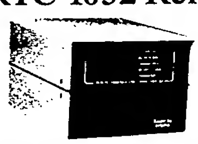


The MGU-1008 is a programmable microprocessor based controller with extensive provisions for automatically controlling load management functions. Manual or automatic operation is permitted for each of up to 5 separate control groups. Each control group can be scheduled as a function of percent load shed, time-of-day, day-of-week, holiday, external sensing, or manual control via keyboard control.The program may be easily changed with inputs via a CRT and keypad. Status monitoring during operation is provided as a real time display on the CRT.

Features:

- Individual control of up to 5 control groups (i.e., water heaters, air conditioners, etc.).
- Cycles of each control group in 5% increments from 0 to 100%.
- Load management may be initiated by: time-of-day, contact from SCADA system or manual control.
- Memory has battery backup to retain program.
- Load management schedules originated or modified easily by menu selections and operator prompts.
- CRT provides summary report of activity.

RTC-1032 Remote Transmitter Controller



The Remote Transmitter Controller (RTC) is a microprocessor-based unit that provides a reliable method of activating remote radio transmitters used in energy management systems. The RTC contains the necessary functions to key up the transmitter, to provide status and control functions, and to modulate the audio signals to load control units installed at customer's facilities.

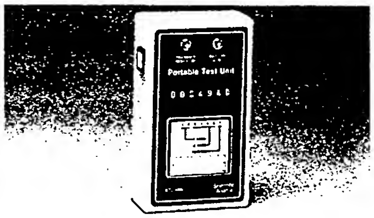
The Master Controller communicates to the RTC a message which tells it the transmitter identification, frequency, type of message, and the Scientific-Atlanta digital message content. The RTC keys the transmitter and generates signals over a 427.5 Hz to 1146.5 Hz frequency range.

Features:

- Audio generation of Scientific-Atlanta's digital signal and single and dual tone formats.
- Control of up to six transmitters.
- Eliminates telephone line distortion when located remotely.
- Message buffering and listen-before-transmit.

H-12

PTU-1084 Portable Test Unit



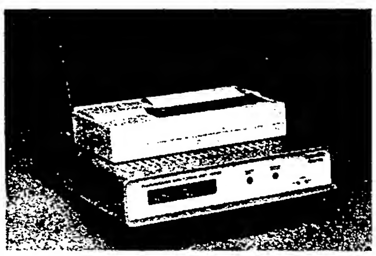
The PTU-1084 Portable Test Unit provides fast, on-site testing, troubleshooting, and checkout of radio controlled switches used in Scientific-Atlanta's load management products. The Portable Test Unit allows manual selection of digital radio signals for transmission to test for proper operation of switches. The economy and portability of the PTU-1084 makes it practical for each switch to be tested as it is installed.

Digital coding is selected via incremental push-to-select switches on the front panel. Message transmission is achieved by depressing the TRANSMIT control.

The PTU-1084 is available in Scientific-Atlanta or GE REMS digital AFSK format, or Golay digital FSK format.

Features:
- Rugged, portable, hand-held test unit.
- Disposable 9V battery with low battery indicator.
- Operator selected digital coding.
- Internal antenna.
- All major manufacturers' code formats available.

TMS-1003B Transmission Monitoring System

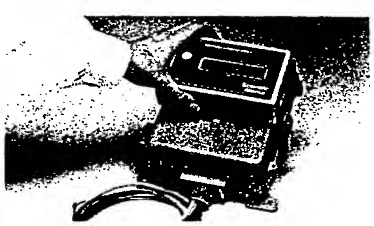


The Transmission Monitoring System monitors the load management radio frequency and provides a permanent record of each message received, including the date and time of transmission. This provides complete documentation for analysis of overall system effectiveness.

An LCD on the face of the TMS continuously displays the date and time until a message is received. At that time, a "carrier detect" LED lights and, if the message is valid, a "message received" LED lights and the printer prints the date, and message(s).

Features:
- Monitors radio transmissions of load management commands to provide permanent record of control activity.
- Provides immediate confirmation that all components of communications channels are functioning.
- Provides complete documentation of all messages sent for use in evaluation and analysis of load management activity.
- Operates unattended.
- Battery backed-up operation.

PCD-1089 Portable Counter Display

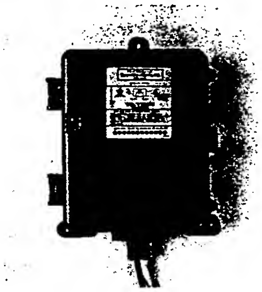


The Portable Counter Display™ is a hand held, battery operated survey instrument which permits gathering of accurate data concerning the performance of a load management system. Designed for use in conjunction with PCD compatible Scientific-Atlanta Digital Control Units, (DCU's), the PCD-1089 uses a low power rf transmitter and an optical receiver to interrogate the DCU's internal memory.

The PCD displays the following critical load management system operation data:
- Number of times each DCU relay has operated
- Number of test messages received by the DCU
- Elapsed time since the counter was reset or frozen
- Switch address
- Whether cold load pick-up is enabled or disabled
- Relay timeout (Scientific-Atlanta and Golay formatted switches only).

Features:
- Provides means for field survey of load management activity.
- Displays switch activity.
- Easy to use.
- Operates from standard 9V battery.
- Available in several manufacturers' formats.

Scientific-Atlanta Digital Control Units



The Digital Control Unit (DCU) is a radio controlled switch designed to switch remote loads on and off in response to commands from a central control, such as Scientific-Atlanta's Load Management Controllers.

The DCU's advanced microprocessor-based design includes both "watchdog" and unique fail-safe driver circuits. The "watchdog" continuously monitors the microprocessor and automatically reinitializes its program should it be disrupted by a lightning surge or other line disturbance. The fail-safe relay driver circuit ensures that output relays are closed in the event of an electronics failure.

Features:

General:

- Reliable microprocessor-based design which can retain record of control activity for use with PCD-1089.
- Simple field programming.
- High performance dual conversion FM receiver with superior sensitivity and selectivity.
- Electronics mounted in removable door for easy field maintenance.
- Cold load start-up disconnects loads when service is restored after an outage.
- Fail-safe timer reconnects load if signal is not received within a field selectable 7.5, 15, 30, or 60 minute time period.
- Fail-safe relay driver circuits reconnect load if electronics fail.
- Weatherproof enclosure of high-impact polycarbonate.

DCU-1170A Series (Scientific-Atlanta Format)

The series DCU-1170 switch responds to messages sent via radio in the Scientific-Atlanta format. This format uses audio frequency shift keying of mark and space tones to represent 256 digital addresses per set of tones.

The DCU-1170A series switch is available in single or dual function configurations with two separate SCRAM codes available.

Features:

- One or two 5 amp and/or 30 amp relays.
- 64 mark and space tones allow coordination between utilities.
- Cold load cancel permits reconnection of load before time-out.

DCU-M1180A Series (Golay Compatible Format)

The DCU-M1180A series switch responds to the Golay 23,12 code. Available in one, two, three and four function configurations, the DCU-M1180A series switch is field programmable with any of the standard Golay 23, 12 addresses.

Features:

- One, two, three or four function.
- Available with up to three 5 amp 120V form C relays, up to two 30 amp 240V Form B relays and/or external relay drivers.
- 8,192 distinct addresses available plus separate function codes.
- Frequency shift keying format.

DCU-G1530 Series (REMS™ Compatible Format)

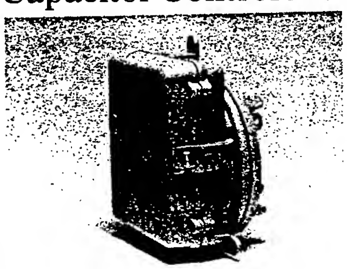
The DCU-G1530 series switch responds to the audio frequency shift keying signaling known as the "GE REMS 100, 101, 102, and SA-105 Formats." The 100 format uses 1200 Hz and 1000 Hz to control the switches, which then time-out. The 101, 102, and SA-105 formats use a "distributed intelligence" technique in which one message from the controller can cause the switch to cycle at a designated rate for up to 8 hours.

The DCU-G1530 switch contains the ability to do all four formats in the same switch. The message received instructs the switch on how to respond.

Features:

- One, two, three or four function.
- Available with up to three 5 amp 120V form C relays and/or up to two 30 amp 240V form B relays and/or external relay drivers.
- 4,096 distinct addresses available plus separate functions codes.
- SA-105 message allows the switch to randomly start (turn off the load) over a period of up to 60 minutes.

Capacitor Control DCU

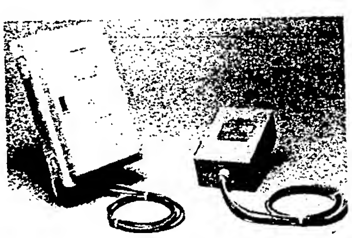


Scientific-Atlanta's Capacitor Control DCU uses the standard DCU enclosure and adds a "Meter Socket Adapter" and other components to provide capacitor control. This permits existing radio load management systems to add system wide control of capacitor banks to their distribution automation program.

Features:

- Any format DCU can be used
- Local on/off/bypass control
- Extra surge protection
- 120 volt power supply

Hybrid System™ Control Units



Scientific-Atlanta's Hybrid System™ offers a unique signalling technique for the Scientific-Atlanta format. This Hybrid System uses a combination of radio and low voltage (240V) power line carrier signalling to control loads. The Hybrid System uses three components to accomplish load control.

RCX-1026

The RCX-1026 is a radio receiver and power line carrier transmitter. Its function is to receive the radio messages, convert the messages to a power line carrier signal and inject the signal onto the secondary side of a distribution transformer.

PLC-1022

The PLC-1022 with a 5 amp relay is mounted near the load to be controlled and receives and decodes the power line carrier message.

PLC-1023

The PLC-1023 functions in the same manner as the PLC-1022 but contains a 30 amp relay.

Features:

- Any number of PLCs on the same secondary can be operated by one RCX.
- The RCX can be installed at the most convenient location on the secondary or high on the utility pole for optimum radio reception.
- Hybrid System can be mixed with Scientific-Atlanta format Digital Control Units in order to most effectively cover a utility's service territory.

Why Purchase a Scientific-Atlanta Load Management System?

TECHNICAL EXPERTISE

- Offers a broad range of technical capabilities in communications systems.
- Offers a microprocessor-based central controller developed from over ten years of utility control experience.
- Offers efficient use of radio spectra.
- Offers a substantial variety of load control strategies and products.
- Offers radio propagation studies to ensure adequate coverage of service territory.

FLEXIBILITY

- Handles a variety of energy management techniques including load control, customer voltage reduction, and other distribution automation functions—all with standard products currently being manufactured.
- Meets existing requirements while providing considerable expansion for future applications.

GROWTH CAPABILITY

- Accommodates new technology, expanding applications and changes in requirements.
- Automated manufacturing facilities in Atlanta with large capacity and potential for expansion.

ECONOMY

- Offers economical installation, operation, system expansion, and change.

RELIABILITY AND SERVICEABILITY

- Offers a practical test and replacement program.
- Services and repairs all equipment.
- Offers manufacturing and support from a United States location.

TRAINING

- Provides on-site training for operation and maintenance of system, including classroom and hands-on training.
- Trains personnel on proper installation of control units.

DELIVERY

- Utilizes high volume production techniques for consistent quality and timely delivery.
- Offers rapid availability of all system equipment.

WARRANTY

- Guarantees all equipment supplied to be free from defects in design, workmanship, and materials for one year from date of installation or 18 months from date of shipment, whichever comes first.

OTHER SERVICES

- Provides proven customer communications package for promotion of load management to utility's consumers.
- Provides detailed instructions manuals.
- Provides ongoing technical assistance for system-related problems.
- Provides installation supervision of central equipment.
- Provides assistance in radio coordination and licensing process.

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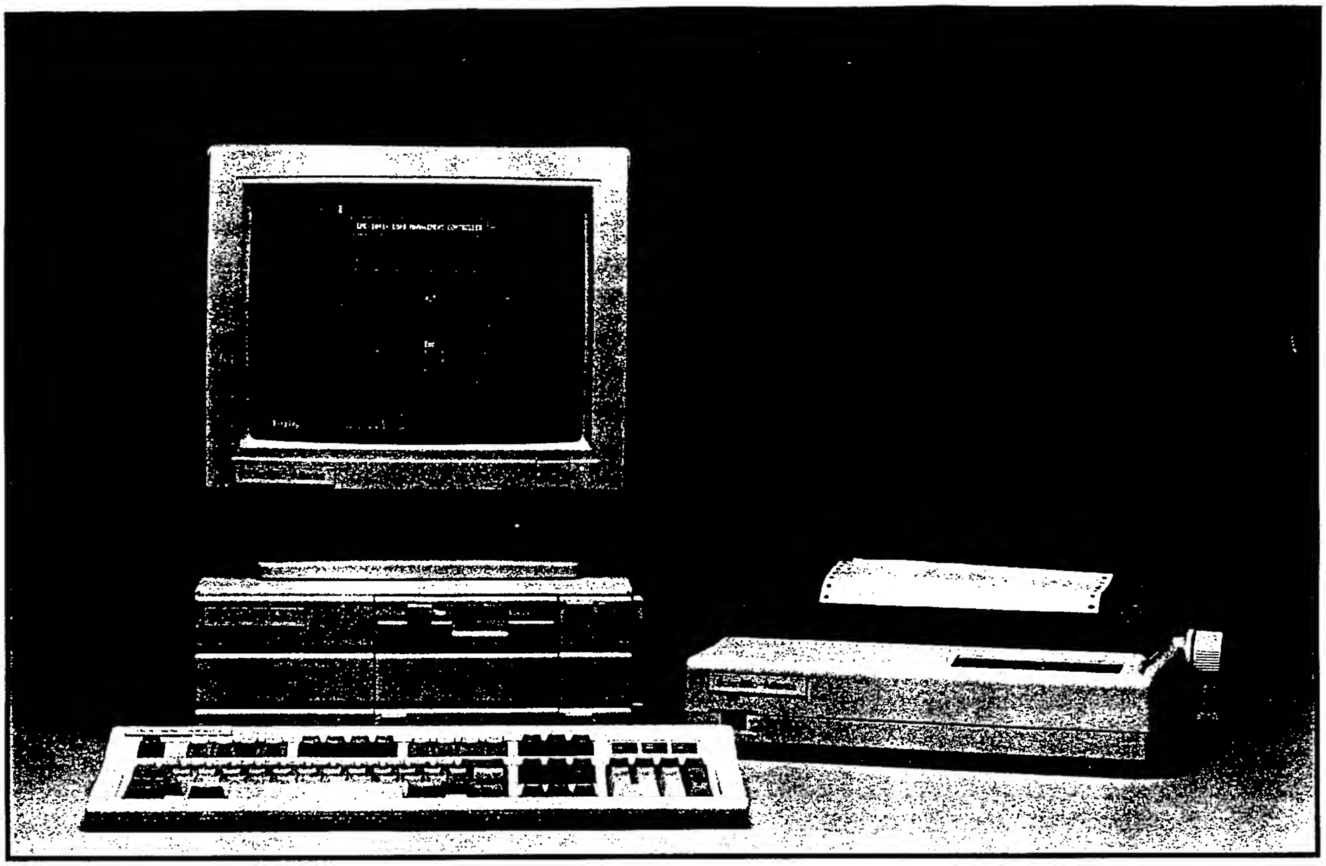
Model LMC-1041+, Load Management Controller



Features

- Combines data acquisition and load control into one machine operating on MS-DOS
- Manual or automatic initiation of load control
- Several load control algorithms are available to the user
- Generates messages in several formats of radio controlled switches
- Program is simple, yet flexible
- Controls air conditioners, water heaters, irrigation pumps, and capacitor banks
- User can define the control "steps" that the program uses
- All programming is done with pop-up menus and operator prompts with on-screen helps
- User defines the number of addresses, number of control groups and strategies he wants and the LMC creates file space to accommodate, limited only by available memory
- Operating characteristics can be modified while the program is running
- Special screens can easily be designed and implemented by the user
- Software supports an optional color monitor
- All software is stored on a hard disk
- Lotus®- compatible historical data files allow easy processing of accumulated data
- Printer can be programmed to automatically print reports
- System automatically restarts in case of power outage
- Interfaces to Scientific-Atlanta's Remote Transmitter Controllers RTC-1032 or RCCA-1002A
- Optional WWV interface ensures accurate timekeeping
- Software supports bar chart and line graphics

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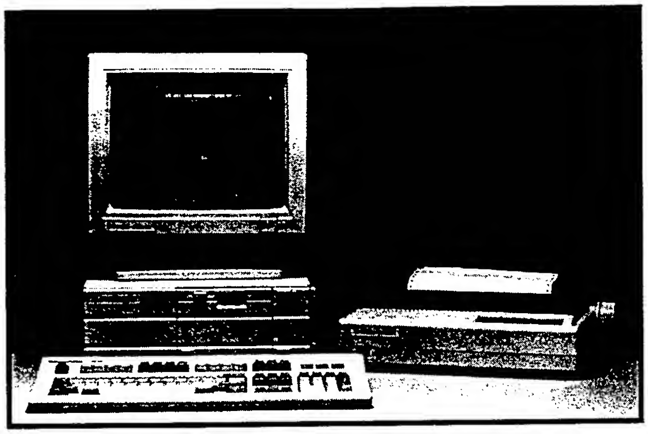
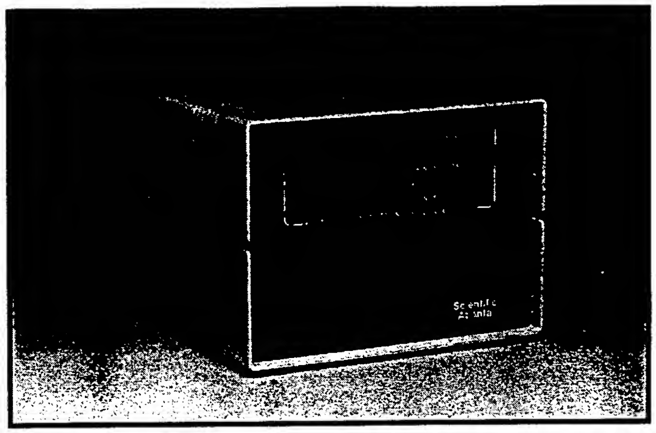
Model LMC-1041+, Load Management Controller



LMC 1041+, Load Management Controller



RTC-1032, Remote Transmitter Controller

Description

The LMC-1041+ is a personal computer based load management controller and data acquisition system. Automatic or manual control commands are initiated by the LMC-1041+ to remotely installed radio receivers. The receivers control loads such as air conditioners, water heaters, pool pumps, irrigation pumps, etc. Power factor control is also possible by remotely controlling distribution feeder capacitor banks.

Data acquisition capabilities of the LMC-1041+ permit monitoring of substation data for display and/or initiation of automatic control functions. Automatic control can be done using kW or kVAR inputs, status point closures, and/or time-of-day and day-of-week schedules.

Capable of outputting all standard Scientific-Atlanta code formats as well as a number of others, the LMC-1041+'s flexible software permits the user to easily configure the system by selecting the options he wants from the pop-up menus, lists of valid entries, and notes which briefly explain what each entry does.

An unlimited number of load groups as well as multiple load control algorithms, time-of-day schedules and control strategies provide ultimate flexibility. The user can even modify existing displays or create new displays to meet his needs using the LMC-1041+ display editor. With this capability he can display the most important "real-time" and explanatory information.

The LMC-1041+ places no limit on the number of strategies, load groups, or switch addresses the utility may use. The user tells the LMC what he wants to do and the LMC creates file space to meet the user's needs. The only limit is the amount of memory available.

The LMC-1041+ program is organized by strategies, setpoints, status points and time-of-day schedules. The user can then apply these characteristics to increase or decrease the amount and type of load to be shed and restored to meet changing control requirements. The user can call for load control algorithms such as cycling at a designated percentage, on/off control, various distributed intelligence strategies, nicking or SCRAM. These can be used in virtually any combination to meet the user's control needs.

The LMC-1041+ also has several features which support the user in operating the system and reporting what has happened. All information can be formatted into a Lotus® compatible file and stored on the hard disk. The printer can be programmed to print out any or all events such as alarms or the automatic initiation of load control.

The LMC-1041+ also uses Scientific-Atlanta's Remote Transmitter Controller (RTC-1032) in this system. An RTC-1032 is located at each transmitter site, connected to the LMC through 1200 baud modems. The RTC-1032 (formerly the RCCA-1002A) receives the messages to be broadcast from the LMC, stores those messages until its proper time slot, keys the transmitter, then generates the proper modulation (tones or shifting frequency) to represent the message.

The RTC can generate most of the formats used in load control today. These include single tone, two tone, Scientific-Atlanta's digital, 100, 102, and SA-105 AFSK formats, and the Golay 23, 12 FSK format.

The RTC can control up to six groups of transmitters (for time slot coordination with other utilities). If a carrier-operated relay is in the transmitter, the RTC can also wait until the air clears before broadcasting.

The LMC-1041+ is typically quoted with the standard hardware shown in the specifications section. The RTC's and modems are quoted separately because each system may require different numbers of transmitters.

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Specifications

LMC-1041+ Hardware

- Personal computer running on MS-DOS operating system with enhanced keyboard and 640K of RAM
- 13" Monochrome CRT
- 3 1/2" 720K floppy disk drive
- 20 MB hard disk
- Dot matrix printer
- Serial port
- Parallel port
- Data acquisition board and connector panel with 8 analog inputs, 8 status inputs, and 8 contacts out
- All interfaces and cables required
- Hardware Options:
  1. Color monitor
  2. Up to 24 analog inputs, 24 status inputs, and 24 contacts out

LMC-1041+ Software

- **Load control**

  1. ***Strategies***
     a. Any number allowed
     b. One or more running at the same time
     c. Any number of load control steps per strategy
     d. Direction of the steps can be changed whether in shed or restore mode
     e. Strategies can be tied to any combination of four status points, analog demands, or time-of-day schedules for automatic initiation of load control
     f. And/or conditionals enhance initiation factors
     g. Strategy activation can be automatic (tied to activation parameters), continuous (constantly active), or in SCRAM mode (to select 100% shed of all points)
  2. ***Steps***
     a. Three types of steps (activation of switch groups, closing control points, or resetting strategy activation level to a new point)
     b. Automatic, continuous, or SCRAM activation of any step
     c. Steps can be linked to make them happen at the same time in either the shed or restore direction.
     d. Information going to the historical data files can be turned on and off
  3. ***Switch Group Steps***
     a. Switch control algorithms
        - Sequential step (on/off in the same order each time)
        - Rotational step (on/off in rotating order)
        - Gradual time cycle (achieve designated % over one time-out period)
        - Fast time cycle (achieve designated % in one burst of messages)
        - Target % load shed (responds to changes in demand level)
        - Nicking (for testing the effectiveness of load control)
        - 102 commands (repeating direct load control)
        - SA-105 commands (distributed intelligence control)

     b. Maximum load shed % for this switch group
     c. Maximum duration of load control for the switch group
     d. Time that the appliance must remain on after reaching its maximum duration before it can be controlled again
     e. Time-out, cycle time and number of repetitions selections in the 102 and SA-105 format switches.
  4. ***Switch Groups***
     a. 1000 addresses per group
     b. Group assigned to a single or all transmitters
     c. Repeat number of messages sent each time (1 or more)
     d. Minimum, nominal, and virtual time-outs
  5. ***Addresses***
     a. Individual addresses can be enabled or disabled
     b. Messages sent can be recorded in a data file
     c. Eight different formats are supported (SA timeout, SA set/reset, single tone, Motorola two tone, Golay, 100, 102 and SA-105)
  6. ***Time-of-Day Schedules***
     a. Schedule name
     b. Programmed for seven days plus holidays
     c. 4 start/stop intervals per day
  7. ***Holiday Lists***
     a. Multiple holiday lists
     b. 20 days per list
  8. ***Transmit Schedule and System Options***
     a. Enable or disable transmissions during each minute of the hour (for coordination with other utilities)
     b. Time slotting for 1 to 6 transmitter groups (divides the minute into 10 to 60 second time slots)
     c. Carrier busy "listen-before-talk"
     d. Password security
     e. WWV time synchronization

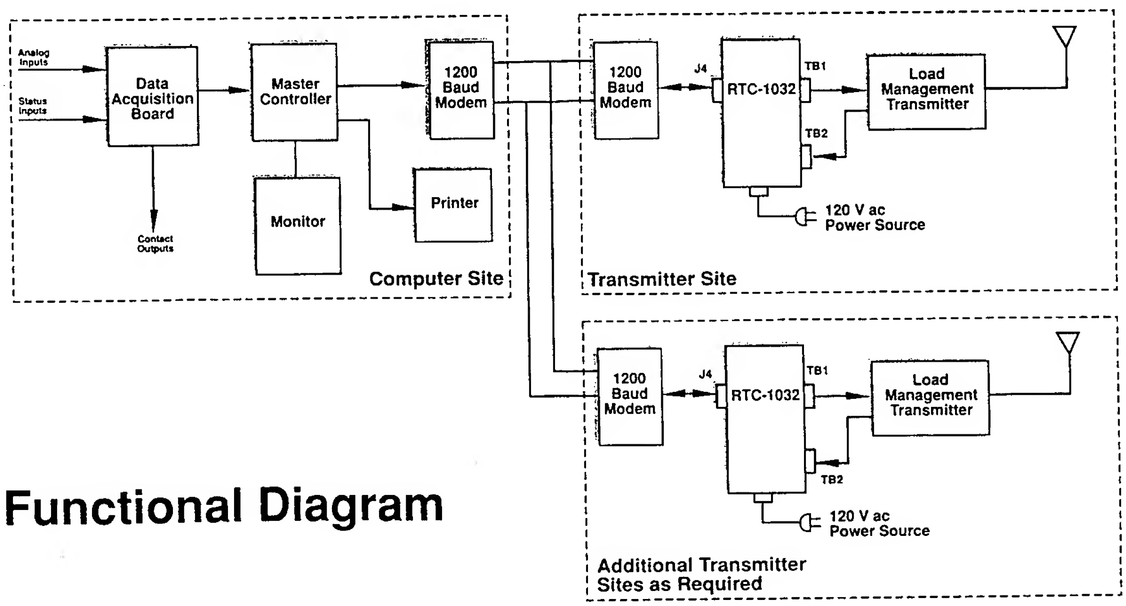
Specifications (Cont.)

- **Data Acquisition**

  1. *Remote Terminals*
     a. Individually addressable
     b. Polling can be enabled or disabled
     c. Polling interval in one minute increments
     d. Up to 24 status points
     e. Up to 24 analog-in points
  2. *Telemetry (analog inputs)*
     a Default values can be assigned in case of communication failures
     b. Scaling mulitipliers are used
     c. Offsets establish starting points
     d. High and low limits establish use of defaults
  3. *Calculate*
     a. Analog values used to calculate demands
     b. Unlimited number of calculations available
     c. 30 different operators can be used
  4. *Demands*
     a. Names
     b. Unlimited number
     c. Combines analog inputs in any manner
     d. Demand interval set from 1 to 60 minutes
  5. *Setpoints*
     a. User designated initiation factors (kW, kVAR, kVA, temperature, etc.)
     b. User sets shed and restore values
     c. User decides the relationship of the shed and restore values
  6. *Control Points*
     a. Name
     b. Up to 24 contacts-out (external)
     c. Unlimited number of internal control points

- **Reporting**

  1. *Printer*
     a. Automatic printing of events (alarms and actions)
     b. Automatic printout of special screens at designated times
  2. *Display building program*
     a. Used to develop special, custom-built screens
  3. *Historical Data Files*
     a. Name
     b. Captures designated display numbers
     c. Establish interval between captures
     d. Establish file sizes
     e. Reset data by day of the month
  4. *Graphics*
     a. Explanatory including lines and boxes
     b. Real time bar and line graphs
     c. User choice of colors, intensity, axes and offsets
  5. *Transmitter Check-Back*
     a. Error indications from the transmitter sites can alarm at the LMC



Functional Diagram

Specifications (Cont.)

- **Miscellaneous**

  1. Pop-up bar type menus
  2. On-screen programmable helps (lists options at each choice)
  3. Programming is done by filling in the blanks
  4. Function keys (F1 - F12) are user programmed to enact control or call up screens
  5. A majority of programming characteristics can be changed while the program is running
  6. Copy configurations to floppy disk
  7. Automatic testing for illegal parameters and relationships
  8. Redundant hardware configuration allows automatic transfer between machines in case of failure

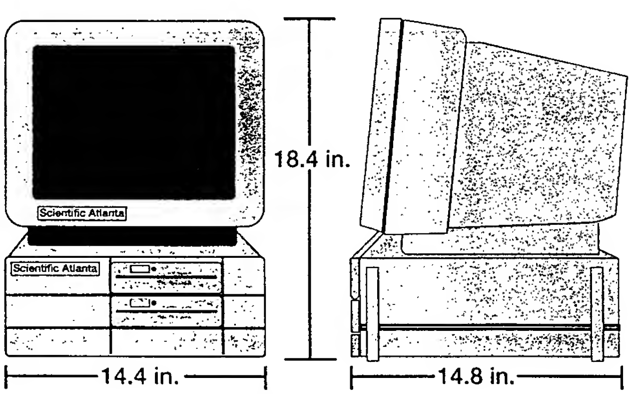
- **Options**

  - Communications package to allow a remote computer to query, modify the program, or enact control

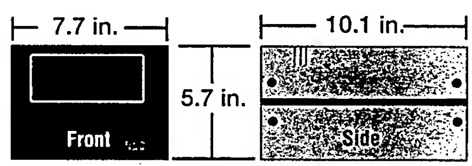
RTC-1032 Remote Transmitter Controller

- Input - 120V ac, 60 Hz
- Power Consumption - 30 watts
- Operating temperature 0°C - +50°C
- Control Output - 6 SPST contacts, 250V ac, 3A
- Communications Modem - 1200 baud, bell 212
- Listen-before-talk - contact closure from carrier operated relay in the transmitter with LBT override (if the channel stays busy)
- Status Input - two contact closures

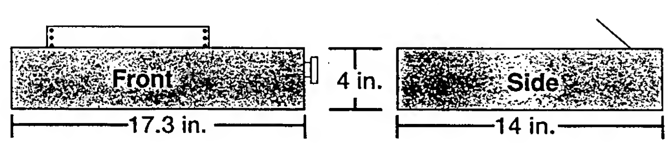
Component Outline Dimensions



Master Station



Remote Transmitter Controller



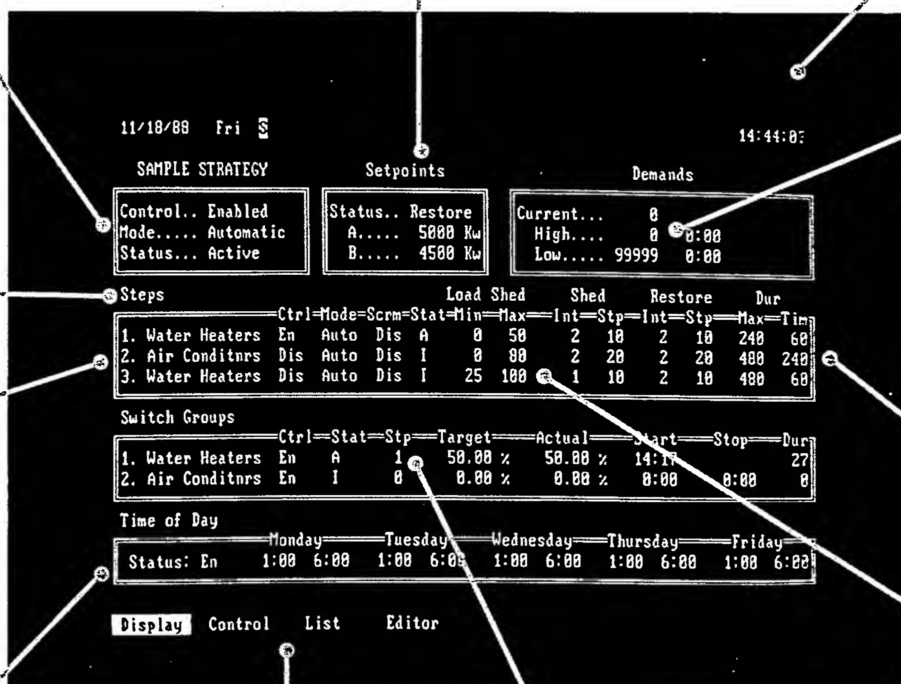
Printer

Typical Load Management Program

Control: Can be enabled or disabled from this page.
Mode: Allows automatic or manual operation.
Status: Shows whether control is active or inactive.

Status: Indicates current load control activity (shedding or restoring).
A: The demand level at which load control is initiated.
B: The demand level at which the program starts restoring the loads.

This screen was "built" by the user from standard information to display the most important information on a real-time basis.



Current: Total system demand.
High: The high demand (with time) for the current period.
Low: The low demand for the current period.

Steps: Define the order of the procedure for controlling load.

Names: The type of load controlled in each step.

Duration: The maximum and current duration of this step being active.

Load Shed–Min and Max: Sets the limits of load shed percentage for this step.

Time of Day: Shows which days and what time of day this strategy can be active (subject to other setpoint demands and/or contact closures).

Main Menu: This can be displayed on any page in the run mode by hitting the (ESC) key.

Step: Describes in which step this switch group is currently being used.

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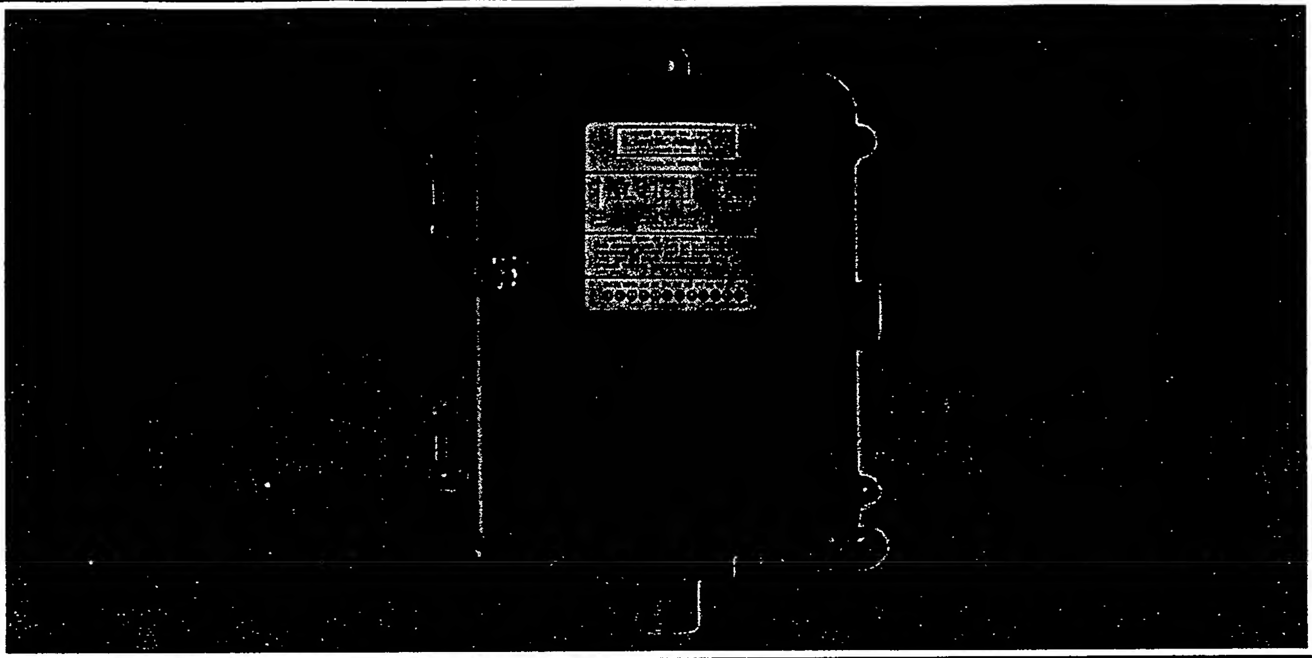
Digital Control Unit DCU-1170A Series



Description

The Digital Control Unit (DCU) is a radio controlled switch designed to switch remote loads on and off in response to commands from a central control such as Scientific-Atlanta's Message Generator Units. Available in single and dual function configurations, the DCU is field programmable with any of 256 individual addresses. In addition, each DCU has two individual SCRAM codes for greater flexibility.

Cold load start up, a feature which disconnects loads when power is restored after an outage, is field selectable. When used, power is restored to disconnected loads on a randomized basis within one timeout period. A special code may be used to cancel cold load start-up and restore loads immediately.

The DCU's advanced microprocessor-based design includes both "watchdog" and unique fail-safe driver circuits. The "watchdog" continuously monitors the mircoprocessor and automatically reinitializes its program should it be disrupted by a lightning surge or other line disturbance. The fail-safe relay driver circuit insures that output relays are closed in the event of an electronics failure.

The DCU-1170A Series is available with an optional electronic multi-function event counter which records and stores the following data:

- Number of activations of each function
- Number of "test" messages received
- Time elapsed in hours since the memory was reset (up to 9 months)
- Cold load pickup status
- Switch address
- SCRAM code

The counter can be read without opening the switch enclosure with a Scientific-Atlanta, hand-held Portable Counter Display, (PCD) Model PCD-1089.

Features

- Reliable microprocessor-based design
- Single or dual function
- Simple field programming
- High performance dual conversion FM receiver with superior sensitivity and selectivity
- Electronics mounted in removable door for easy field maintenance
- Two SCRAM codes
- Cold load start-up disconnects loads when service is restored after an outage
- Fail-safe timer reconnects load if signal is not received within a field selectable 7.5, 15, 30 or 60 minute time period
- Optional set-reset operation causes each function to cancel the other when it activates
- Fail-safe relay driver circuits reconnect load if microprocessor fails
- Weatherproof NEMA 4 enclosure of high-impact plastic

Optional Features

- Selection of 5 amp/24V ac or 30 amp 240V ac relay contacts
- External antenna connector
- Alternate operating voltages
- Self testing electronics with ROM/RAM diagnostics
- Test LED to indicate test code received (no relay operation). Separate test codes may cause lamp to either light or blink.
- LED indicator to show relay(s) energized
- Cold load delay causes cold load pickup feature to ignore power outages of up to 30 seconds
- Address coding by upright pins and jumper caps allows easy field reprogramming of the switch without soldering

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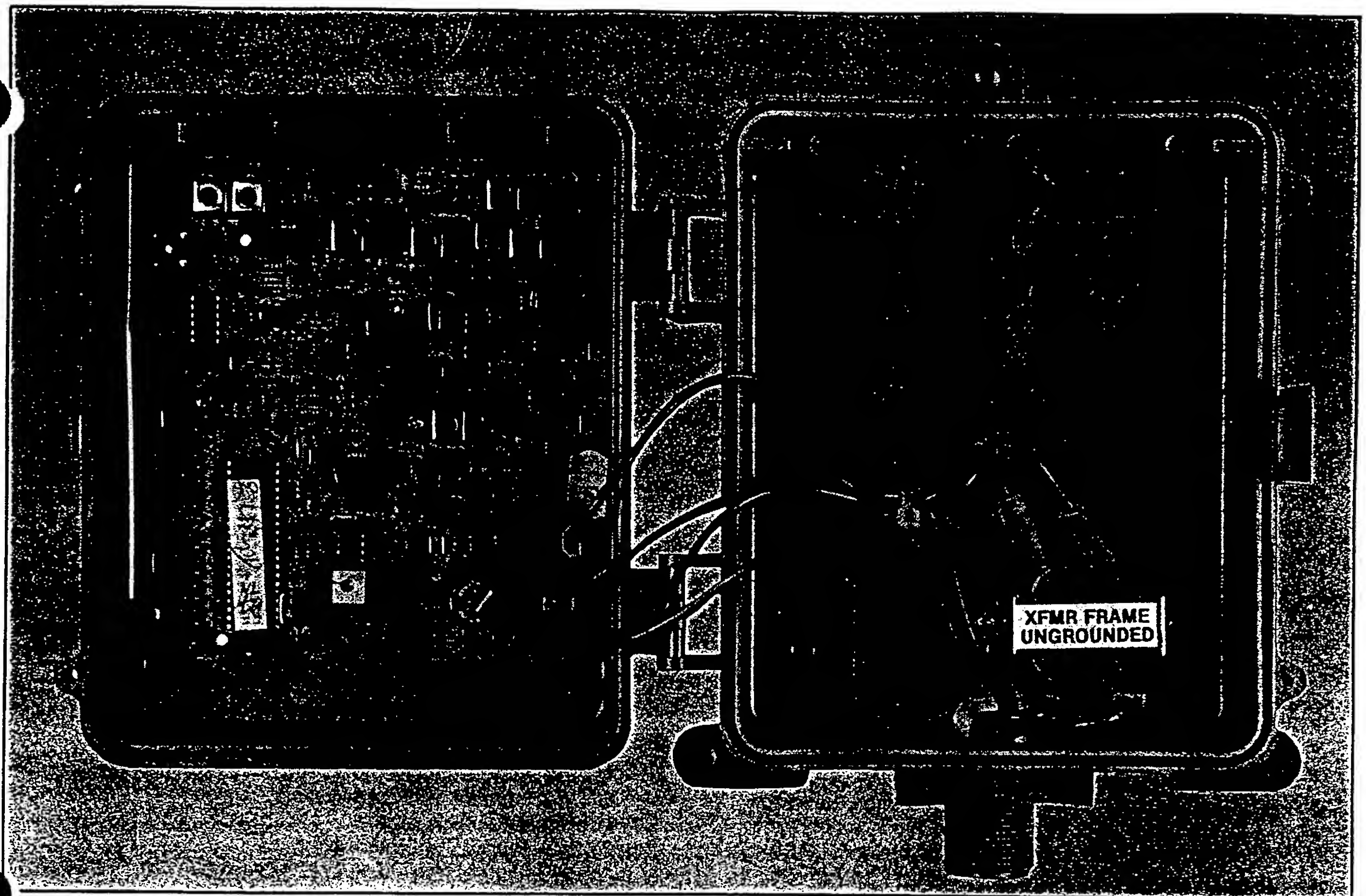


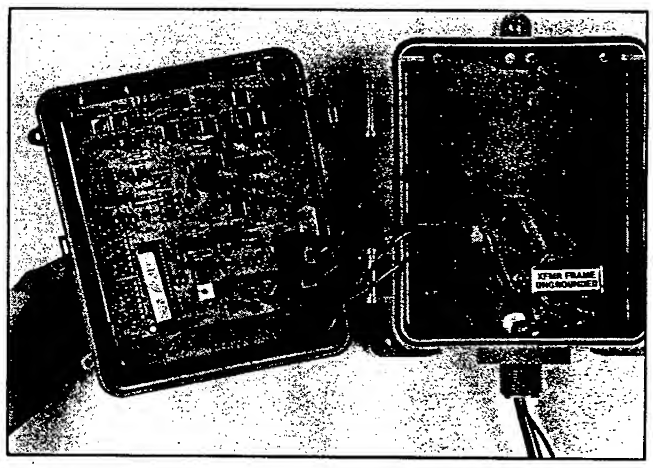
All electronics are conveniently located in a removable door for ease of maintenance and service.

Optional features include a test LED which indicates reception and decoding of a Scientific-Atlanta digital message. This indicator allows verification of proper system operation after installation without activating the control relay. Separate test codes transmitted to the DCU may cause the LED to either light or blink. In addition, the same LED is used to indicate the results of the DCU's microprocessor self testing diagnostic routine. When the DCU is energized, or a special test code is received, a complete self-test of both the ROM and RAM is performed and the LED will blink to indicate test results. This feature provides verification of the electronics integrity at the time of installation.

Other optional LED's are available to show control relays are energized.

Typical applications are:

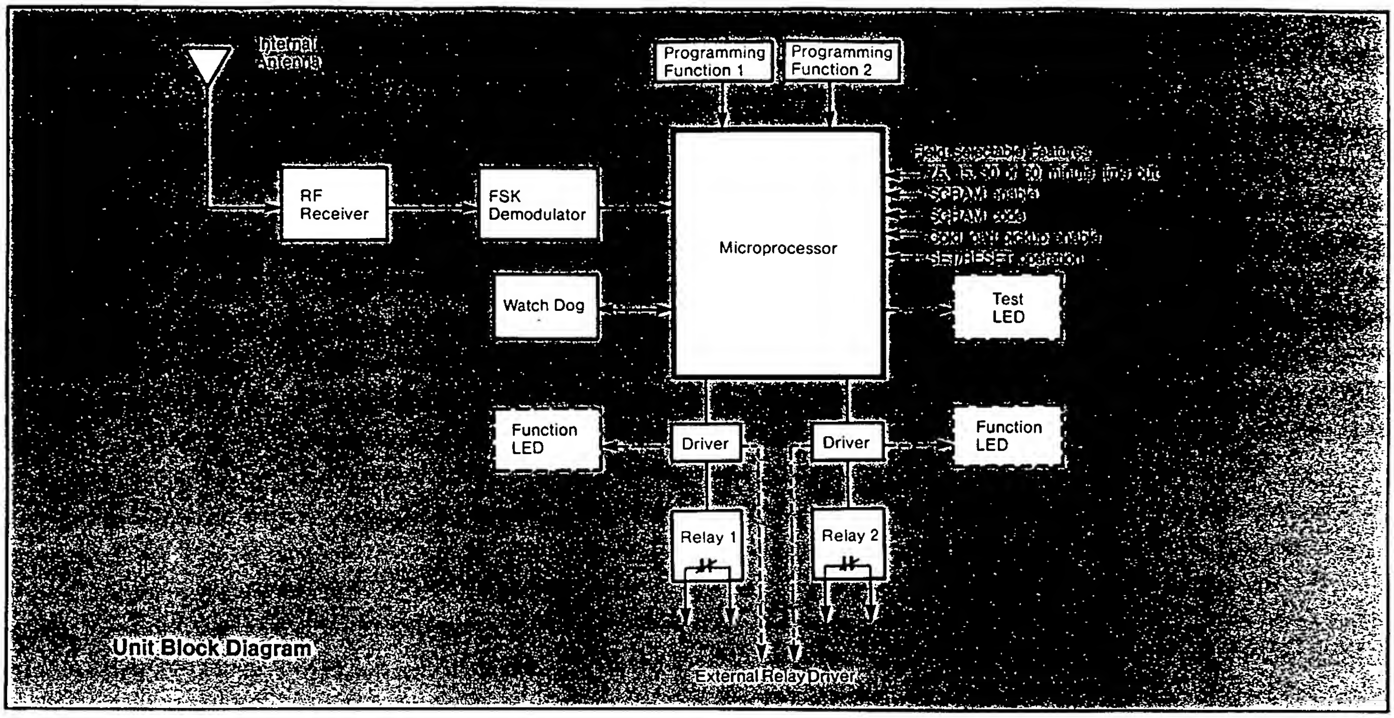
- Residential direct load control
- Power factor capacitor switching
- Voltage regulation control
- Water pumping control
- Implementation of interruptible rates
- Traffic signal control
- Sprinkler system control



Electronics are mounted in removable door for easy field maintenance.

Operation

The DCU is a radio switch that responds to digitally-encoded RF signals. The unit is not sensitive to mechanical vibrations since solid state components are used throughout.
The digitally encoded message which controls the DCU utilizes two-frequency pulse width modulation (PWM) in frequency shift keying (FSK) format. The high performance, dual conversion radio receiver in the DCU detects the RF signal and demodulates the carrier, recovering the FSK tones. An FSK decoder derives a serial pulse train. By precisely timing the pulse widths, the digital decoder recovers an 8 bit code and compares it to a programmed code. If the codes agree, the control relay is activated and a timer is initiated. If the correct code is not received again within the programmed timeout period, the control relay is deactivated. Retransmitting the correct code extends the control time an additional period from the time it is received.



Unit Block Diagram

Specifications

General

Input Voltage
240V ac ±15%, 60 Hz (Standard)
120V ac ±15%, 60 Hz (Optional)
24V ac ±15%, 60 Hz (Optional)
240/480V ac ±15%, 60 Hz (Optional)

Power Consumption
5 watts maximum

Operating Temperature
−30°C to +60°C

Humidity
0% to 100%, non-condensing

Transient Voltage Protection
Exceeds ANSI C37-90A-1974

Weight
2.2 lbs.

Shipping Weight
2.7 lbs.

Enclosure
Injection molded, high impact strength plastic
Electronics mounted in removable door

Dimensions
9.7″H x 7.1″W x 3.0″D

Receiver

Type
Narrowband FM, dual conversion, crystal controlled

Sensitivity
Typically 20 μV per meter

Frequency
154.46375 MHz (other frequencies available on special order)

Frequency Stability
.002% over operating temperature range

Image Rejection
40 dB

Selectivity
50 dB minimum ±20 kHz; 100 dB minimum ±30 kHz

Certification
FCC and UL

Decoder/Controller

Microprocessor
8 bit with self-test diagnostics

Code Transmission Format
Two frequency pulse-width modulation (FSK)

Fail-Safe Timer
7.5, 15, 30 or 60 minutes, ±1.5 minutes randomization

Output Relays
5 amps resistive @24V ac, Form B (SPST) or 30 amps resistive @240V ac, Form B (SPST) contacts
Fail-safe relay drivers close relay contacts in event of microprocessor failure.

Watchdog circuit monitors microprocessor for correct operation.

User Programmable Functions:
256 address codes
Enable or disable SCRAM
Select between two (2) independent SCRAM codes
Enable or disable cold load pickup
Select 7.5, 15, 30 or 60 minute timout
Select set/reset operation (either function cancels the other)

Test Functions
Microprocessor self-test on energization
Special Codes:
1) Turn test LED on
2) Turn test LED off
3) Cause test LED to blink

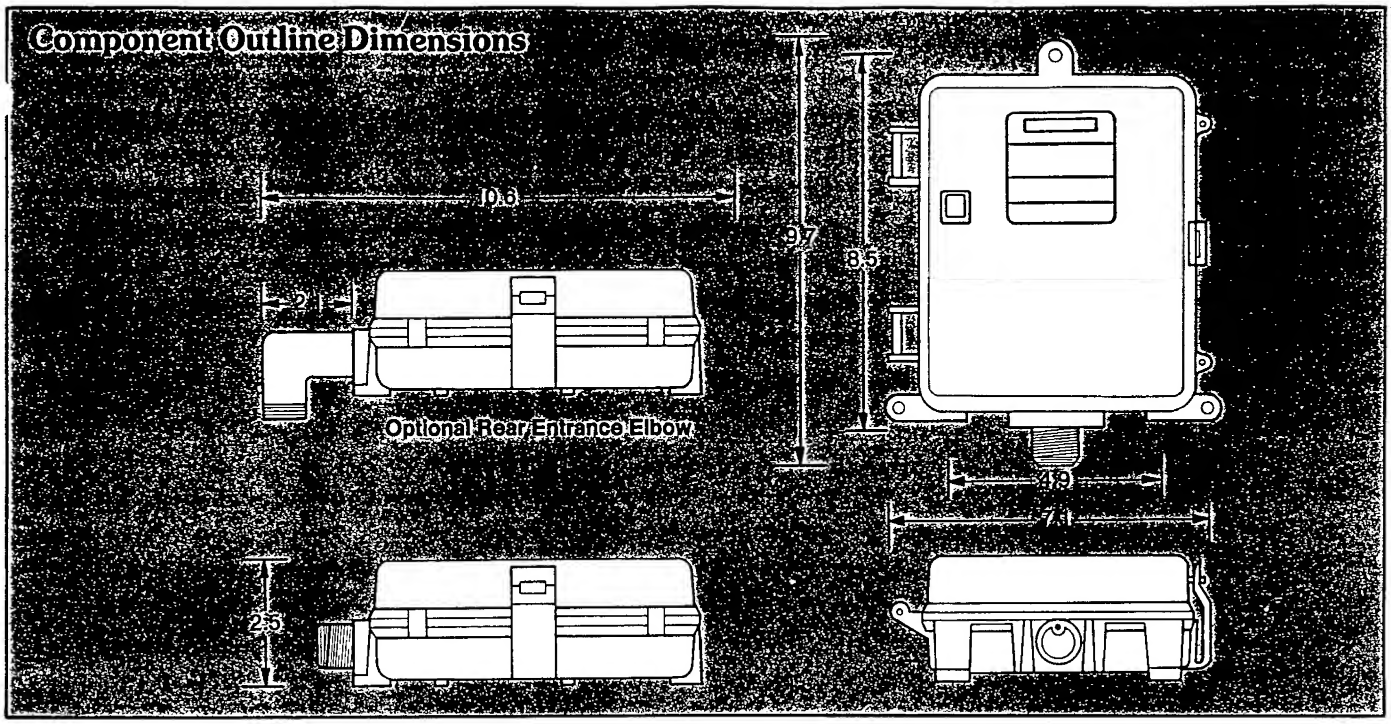
LED Indicators (optional)
One (1) for each output relay to show contact position
One (1) for test codes and signal reception indicator

Other Functions
Cancel cold load pickup before timeout

Optional Features

Electronic Event Counter
External relay driver
External antenna connection
Address coding by upright pins and jumper caps
CATV System Interface
Rear entrance elbow (see outline drawing)
Test LED to indicate test code received and the results of ROM/RAM tests
LED to indicate control relay(s) energized
Operating Voltage
a) 24V ac
b) 120V ac
c) 240/480V ac
d) 120/240V ac
Three wire connection (single function unit only)
Cold load delay (cold load pickup ignores power outages of up to 30 seconds)

H-25



Control Unit Relay Options and Model Number

Model	Function 1 Contact Rating, Wire Size & Color
DCU-1170A	5 Amp, 24V ac, 2 Blue No. 18
DCU-1171A	30 Amp, 240V ac, 2 Blue No. 10
DCU-1172A	5 Amp, 24V ac, 2 Blue No. 18
DCU-1173A	5 Amp, 24V ac, 2 Blue No. 18

Model	Function 2 Contact Rating, Wire Size & Color
DCU-1170A	N/A
DCU-1171A	N/A
DCU-1172A	30 Amp, 240V ac, 2 Yellow No. 10
DCU-1173A	5 Amp, 24V ac, 2 Yellow No. 18

Above models rated for 240V ac operation. Power wires; 1 Black, 1 Red, No. 12.

Optional operating voltages shown below.

Suffix Desig.	Operating Voltage	Power Wire Size and Color
–1	24V ac	1 Blk, 1 Red, No. 18
–2	120V ac	1 Blk, 1 Red, No. 12
–3	240/480V ac	1 Blk, 1 Red, 1 Violet, No. 12
–4	120/240V ac	1 Blk, 1 Red, 1 Violet, No. 12

All wires are 18" in length, insulated to 600V at 105°C.

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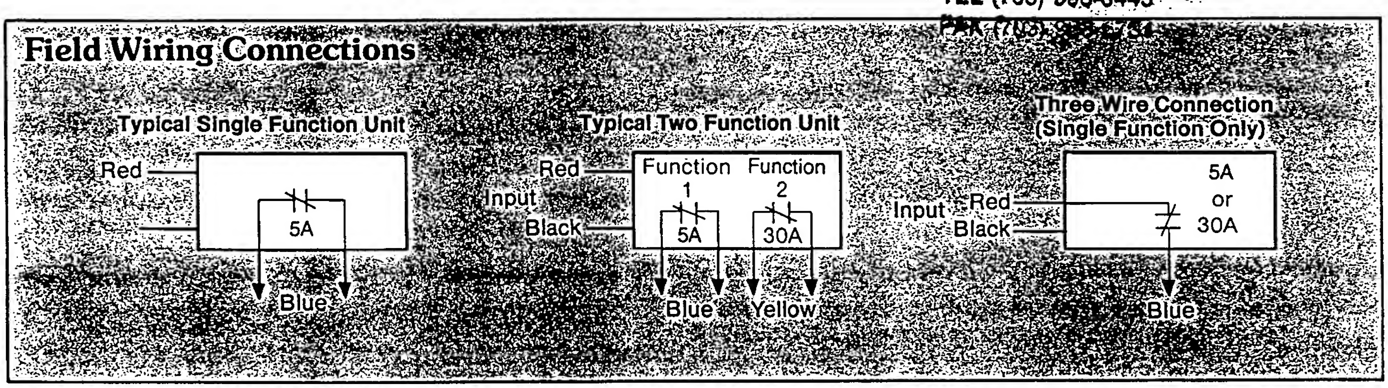

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PLC

PCC TRANSMISSION THEORY

INTRODUCTION

Powerline Control Components (PCC) are electronic wiring devices designed for industrial and commercial installations. These components provide centralized, remote and local control of electrical loads by superimposing a 120 KHz carrier signal upon the existing power conductors supplying the loads. The devices can control up to 256 separate addresses; each address can switch up to 50 receivers and their respective loads as a group. Programmable controllers, personal computer and other interfaces are available which can automatically actuate commands for all addresses. Override can be exercised using wall-mounted, push button, dry-contact or table top manual controllers.

Powerline Control Components consist of three types: transmitters, receivers and coupling devices and are compatible with common distribution voltages, both single and three phase. The theory of operation is the same for all devices regardless of the input voltage. Transmitters send coded signals via coupled AC power circuits to PCC receivers which control loads connected to them. Coupling equipment is necessary to enhance signal transmission, couple phases and compensate for phase shifts encountered in multi-voltage/multi-transformer installations.

Transmission Synchronized to Zero Crossing

PCC transmitters are powered by either 120 V or 277 V standard AC power and transmit digitally encoded 120 KHz signal bursts onto the existing electrical wiring. These signals are synchronized to the zero crossing of the power to which the transmitter is connected. Transmission at this point has the advantage of avoiding noise spikes generated by other equipment which generally do not cause noise near the zero crossing. The signal is transmitted three times at 0, 60 and 120 degrees referenced to the zero crossing to which the device draws its power, this coincides with the phase to neutral zero crossing points of all phases of a three phase system. Figure 1 shows the timing relationship of these bursts to the zero crossing. A binary 1 is represented by a 1 millisecond burst of 120 KHz. at the three zero crossing points and a binary zero by the absence of the burst. The signals in Fig. 1 are shown as they would be seen through a high pass filter. The 60 Hz. waveform is only shown for reference. In reality, the signals are actually superimposed on the 60 Hz. waveform and look similar to that shown in Fig. 2.

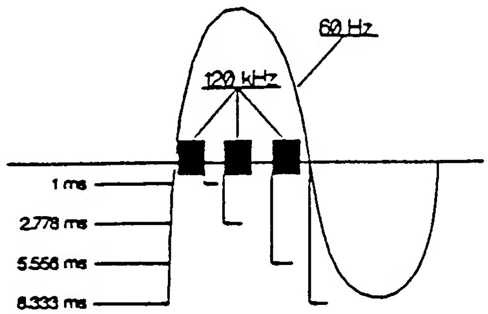


Fig. 1

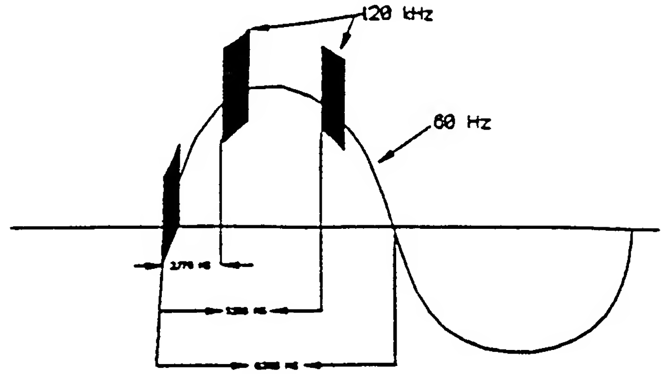
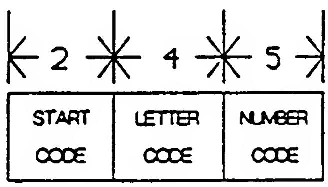


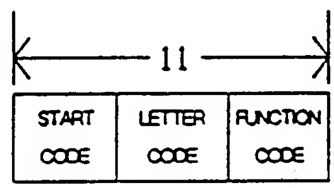
Fig. 2

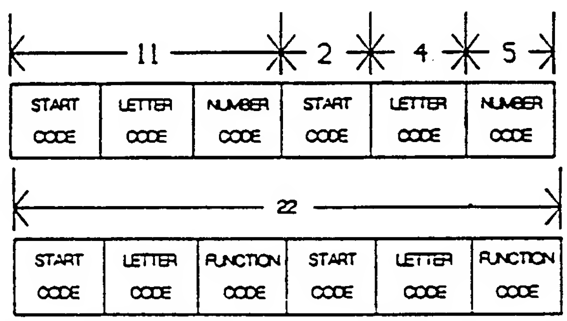
Code Structure

A complete code transmission encompasses eleven cycles of the power line. The first two cycles represent the Start Code (always 1110). The next four cycles represent the Letter Code (A thru P) and the last five cycles represent either a Number Code (1 thru 16) or a Function Code (On, Off, Bright, Dim, All Lights On, All Units Off).



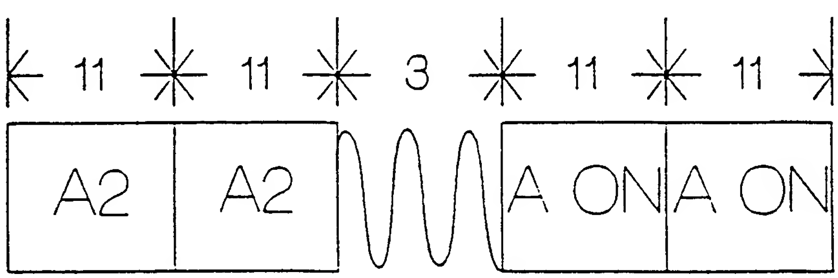
OR





These codes are transmitted twice making the total length twenty-two cycles.

The codes are transmitted in blocks consisting of the two groups of 22 cycles separated by 3 cycles.



The 3 cycles between each pair of code transmissions is a "silence" and is required by the receiver module's circuitry. Bright and dim commands are exceptions to the 3 cycle rule and can be transmitted continuously with no gaps between the same codes, (dim and dim). The three cycle gap however is necessary between different codes, (i.e. between bright and dim or on and off commands).

Within each block of data the code is transmitted in both true and complement form on altewmate half cycles of the power line, i.e. if a burst of signal is transmitted on one half cycle (a binary 1) then no signal is transmitted on the next half cycle, (binary 0). See Fig. 4 below. This complement form applies to the data portion of the block only. The start code is 1110 and is always transmitted on the first 2 cycles of the block.

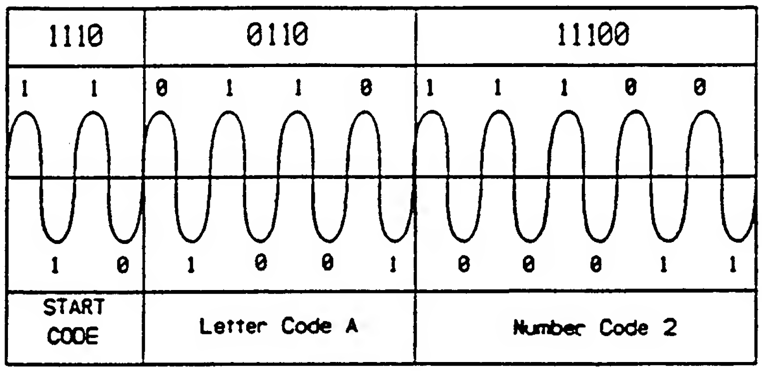


Fig. 4

The following table shows the binary representation of each code used.

A 0110	1 01100
B 1110	2 11100
C 0010	3 00100
D 1010	4 10100
E 0001	5 00010
F 1001	6 10010
G 0101	7 01010
H 1101	8 11010
I 0111	9 01110
J 1111	10 11110
K 0011	11 00110
L 1011	12 10110
M 0000	13 00000
N 1000	14 10000
O 0100	15 01000
P 1100	16 11000
All Off 00001	All Lights On 00011
On 00101	Off 00111
Bright 01011	Dim 01001

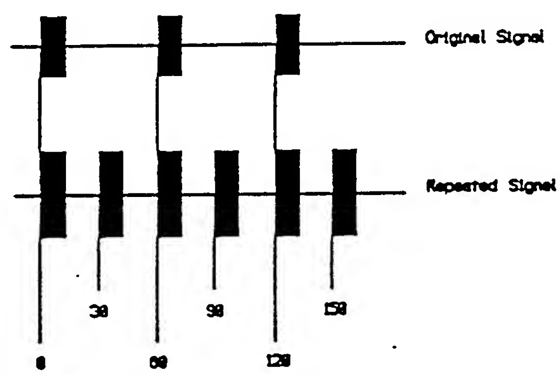
Repeated Signal

Coupler-repeaters are used to maintain signal integrity and allow signals to be seen in distributions which are out of phase with the transmitter supplying the original signal. The transmitters signal (approximately 3V) attenuate as distance from the transmitter increases. Since signals of at least 100mV at the proper zero crossing are required at the receiver for proper operation, a means of regenerating and shifting the signal is necessary. The coupler-repeaters perform this task by monitoring the power lines for valid signals. It then amplifies them at the original zero crossing and repeats the amplified signal with a 30 degree shift. This happens on each phase so that all six possible zero crossings have signal available. The coupler-repeater uses the codes' redundant transmission to accomplish this function. As original signal is transmitted, the coupler-repeater reads the first transmission of the code and amplifies it at exactly the same time as the second transmission occurs, as depicted in the diagram below.

START CODE	LETTER CODE	NUMBER CODE	START CODE	LETTER CODE	NUMBER CODE
			START CODE	LETTER CODE	NUMBER CODE

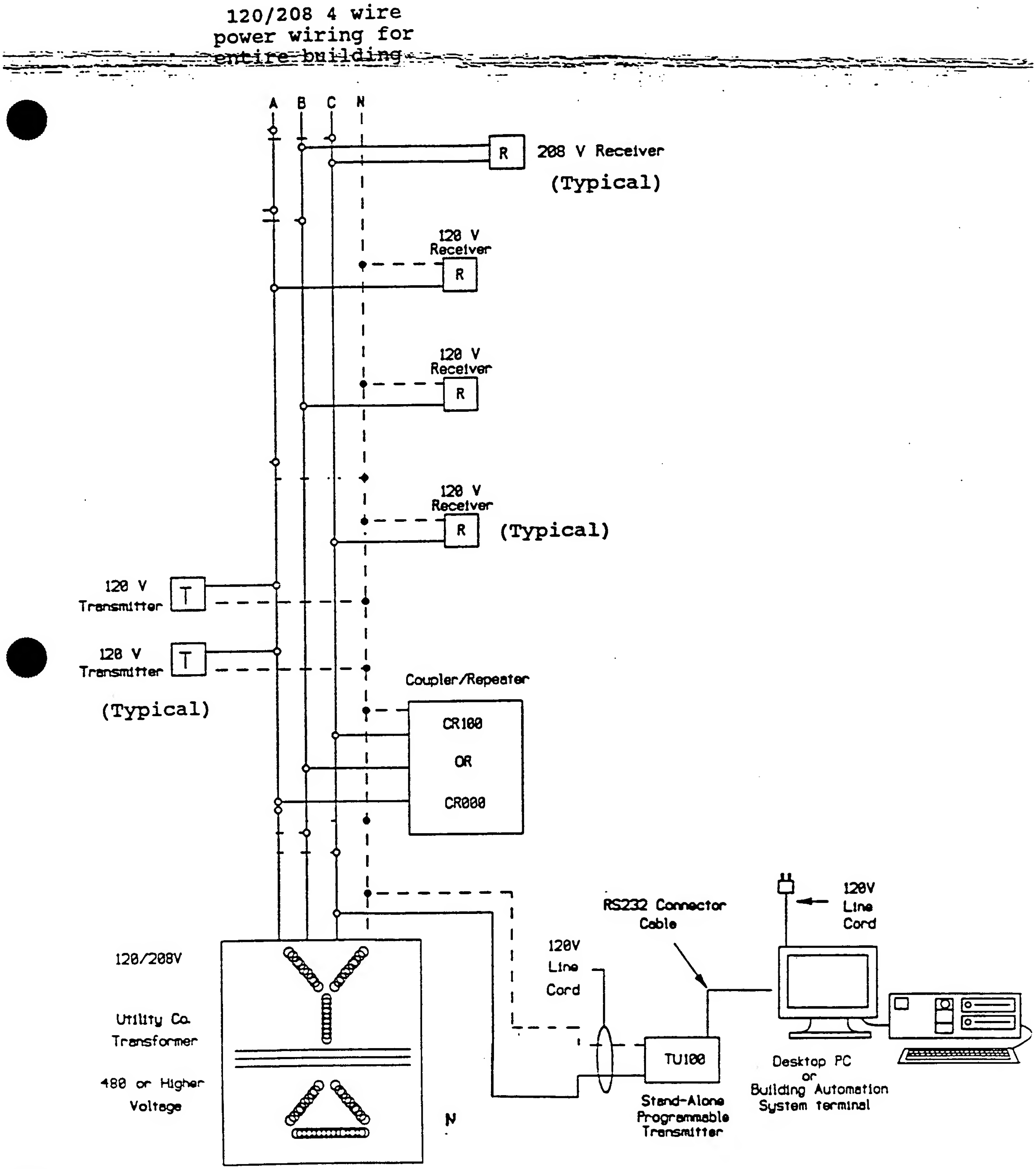
START CODE	LETTER CODE	FUNCTION CODE	START CODE	LETTER CODE	FUNCTION CODE
			START CODE	LETTER CODE	FUNCTION CODE

It then transmits a new amplified 30 degree shifted signal for use by recievers in other distributions or otherwise referenced to a 30 degree shifted zero crossing.



The amplification allows signals to travel much further than they normally would to reach distant receivers with sufficient signal strength. The repeating function allows the use of receivers referenced to zero crossings other than that of the original transmitter, i.e. receivers connected to 120V distributions can receive signals created by a transmitter located in a 277V distribution provided the proper PCC devices were provided to couple the transformers between the distributions. The PCC Source Book or Specifier Manual provides specific information on all coupling devices available. For more information call the PCC Techline at 1-800-886-2281.

SECTION C



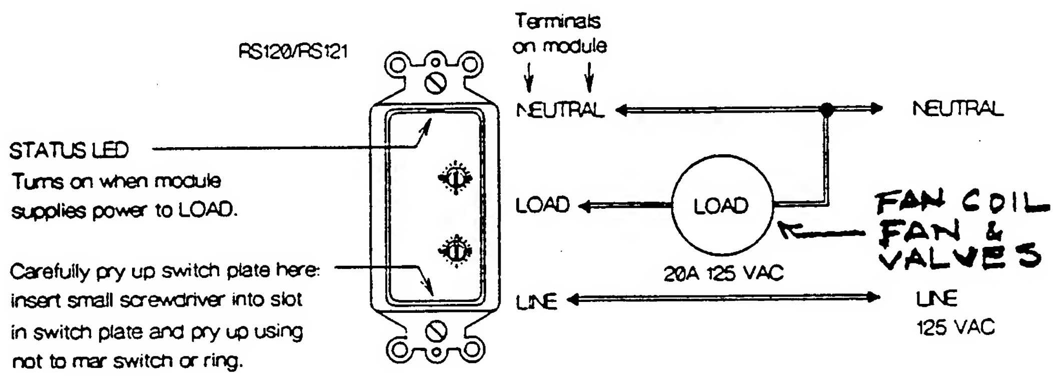
POWERLINE CARRIER SYSTEM FLOW DIAGRAM

RS120 - RS121

PCC 125 VAC Single Pole Feed-Thru Switch

To make connections to RS120/RS121:
loosen screw clamps on side of module,
seat screw to expose clamp, strip wire & insert into appropriate socket on back of module
then retighten screw clamps.

To set address codes:
insert small screwdriver into slot on code dials
and turn until arrow points to desired letter and number code.
Remount switch plate by gently pushing it back into position.



BEFORE YOU BEGIN...

READ ALL INSTRUCTIONS

Make sure your installation will conform to all applicable codes and requirements.

TEST FOR SIGNAL STRENGTH AND NOISE...

using the AR300 and AT300. It is necessary to test the installation in the actual operating environment. The amount and types of line loads may reduce the strength of the transmitted signal and/or electrical noise may cause interference with the transmitted signal. Proper installation may require additional couplers, filters or repeaters. Special coupling devices are required to allow signal to be distributed to all phases and zero-crossings in multi-phase and multi-transformer distributions.

IF YOU HAVE ANY QUESTIONS...

Consult your nearest Engineered System Center (ESC) for additional information.

There are no field repairable assemblies on this unit. It is covered by a two year limited warranty. If service is needed, the unit must be returned to the ESC where purchased. Contact your ESC for return details.

INSTALLATION

CAUTION! Make all connections with the **POWER OFF** to avoid injury to the installer or damage to the device.

NOTE! This switch is not intended as an exact replacement for standard wall switches. The Neutral terminal MUST be connected to a Neutral (not simply a white lead used as a traveler fo a load).

1. Using the STRIP GAUGE on the back of the module, strip insulation from the ends of the conductors. Loosen the appropriate screw clamp on the side of the module. Push the screw against its seat to expose the clamp, insert the wire and retighten the screw clamp. Make connections as shown in the Wiring Diagram. The connection to the neutral terminal of the module does not have to be the neutral of the load.

2. Check connections to be sure they are tight and no bare conductors are exposed.

   NOTE! Tighten all screw clamps securely.

3. Make sure the load or installation does not exceed the device rating.

4. Install into a standard single or multi-gang electrical wall box. Use a deep box to avoid interference with box fittings and allow room for wiring connections.

   Mount the device in the wallbox and install the cover plate/trim ring (Decora ™ or compatible style available through electrical supply vendors).

CHECKOUT

1. Restore the power.

2. Set the address:

   Up to 256 addresses can be selected from the module. The address consists of a Letter Code (A through P) and a Number Code (1 through 16) for Unit address. Set the address code dials as shown in the Wiring Diagram.

3. Test Local Operation:

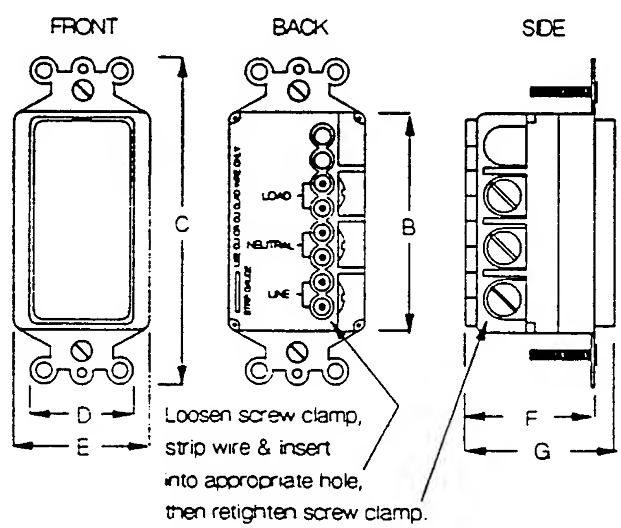
   Depress the switch plate several times to ensure the module turns the controlled load on and off in response to manual control.

4. Test Remote Operation:

   Using a controller, transmit "OFF", "ON", "ALL OFF" and "ALL LIGHTS ON" commands to ensure the device turns the controlled load on and off in response to remote control.

5. Test for Signal Strength and Noise once again using the AR300 and AT300.

RS120/RS121 RATING:
20 Amps
125 VAC (+/-10%) 60 Hz
DIMENSIONS:
A: 4.1 in (104mm)
B: 2.75 in. (70mm)
C: 2.6 in (66.5mm)
D: 1.3 in. (33mm)
E: 1.7 in. (43mm)
F: 1.55 in. (39.4mm)
G: 1.85 in. (46.5mm)



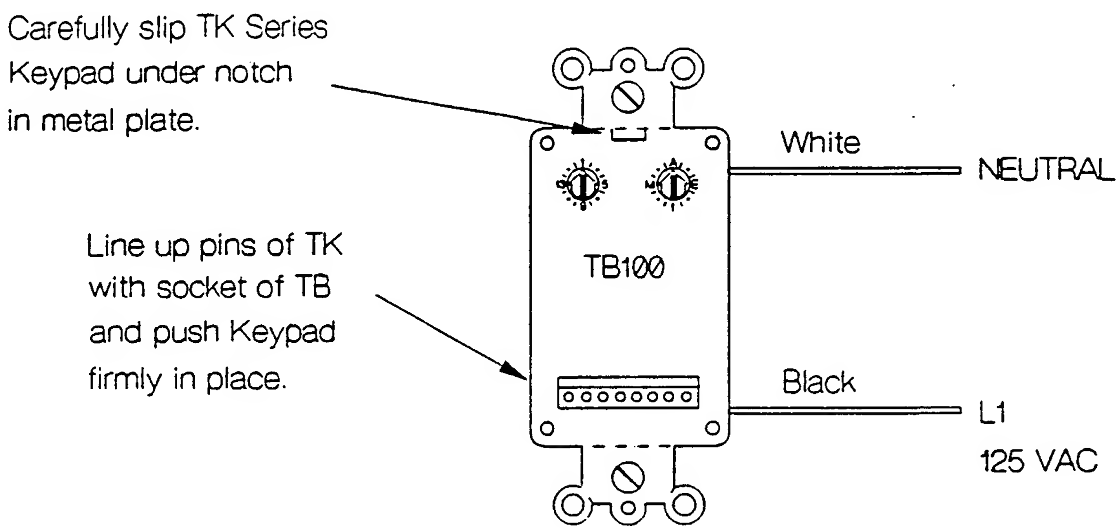
H-35

TB100

PCC 125 VAC Transmitter Base

See TK Series Keypad installation instructions for proper checkout procedures when using the TB Series Transmitter Bases.

To set address codes: insert small screwdriver into slot on address code dials and turn until arrow points to desired letter and number code.



BEFORE YOU BEGIN...

READ ALL INSTRUCTIONS

Make sure your installation will conform to all applicable codes and requirements.

TEST FOR SIGNAL STRENGTH AND NOISE...

using the AR300 and AT300. It is necessary to test the installation in the actual operating environment. The amount and types of line loads may reduce the strength of the transmitted signal and/or electrical noise may cause interference with the transmitted signal. Proper installation may require additional couplers, filters or repeaters. Special coupling devices are required to allow signal to be distributed to all phases and zero-crossings in multi-phase and multi-transformer distributions.

IF YOU HAVE ANY QUESTIONS...

Consult your nearest Engineered System Center (ESC) for additional information.

There are no field repairable assemblies on this unit. It is covered by a two year limited warranty. If service is needed, the unit must be returned to the ESC where purchased. Contact your ESC for return details.

INSTALLATION

CAUTION! Make all connections with the **POWER OFF** to avoid injury to the installer or damage to the device.

NOTE! This transmitter is not intended as an exact replacement for standard wall switches. The white lead MUST be connected to a Neutral (not a white lead used as a line voltage "feeder" to a load).

1. Strip 3/4" of insulation from the ends of the conductors and make connections as shown in the Wiring Diagram.
2. Check connections to be sure they are tight and no bare conductors are exposed.
3. Make sure the load or installation does not exceed the device rating.
4. Set the address:

   Up to 256 addresses can be selected from the module. The address consists of a Letter Code (A through P) and a Number Code (1 through 16) for Unit address. Set the address code dials as shown in the Wiring Diagram.
5. Install the appropriate TK Series Keypad as shown in the wiring diagram.
6. Install into a standard single or multi-gang electrical wall box. Use a deep box to avoid interference with box fittings and allow room for wiring connections.

   Mount the device in the wallbox and install the cover plate/trim ring (Decora ™ or compatible style available through electrical supply vendors).

CHECKOUT

1. Restore the power.
2. Test Local Operation (TK Series Keypads Only):

   Refer to the installation instructions for the TK Series Keypads for additional information. Push the rocker switches several times to ensure the module controls the load in response to manual control.

4. Test Remote Operation:

   Using a controller, transmit "OFF", "ON", "ALL OFF", "ALL LIGHTS ON", "DIM" and "BRIGHT" commands (as appropriate for the Keypad used) to ensure the device turns the controlled load on and off in response to remote control.
5. Test for Signal Strength and Noise once again using the AR300 and AT300.

TB100 RATING.

No Load

125 VAC (+/-10%) 60 Hz

DIMENSIONS.

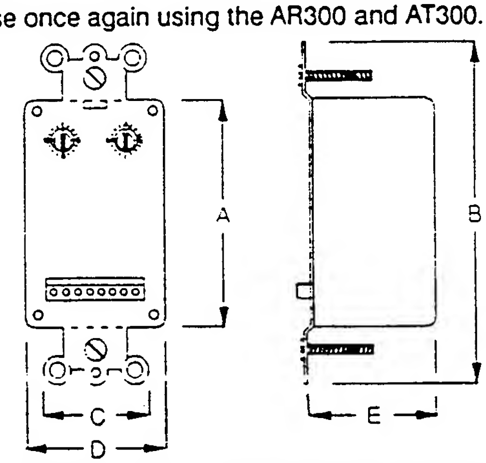
A: 2.75 in. (70mm)

B: 4.1 in. (104mm)

C: 0.95 in. (23.5mm)

D: 1.75 in. (44.5mm)

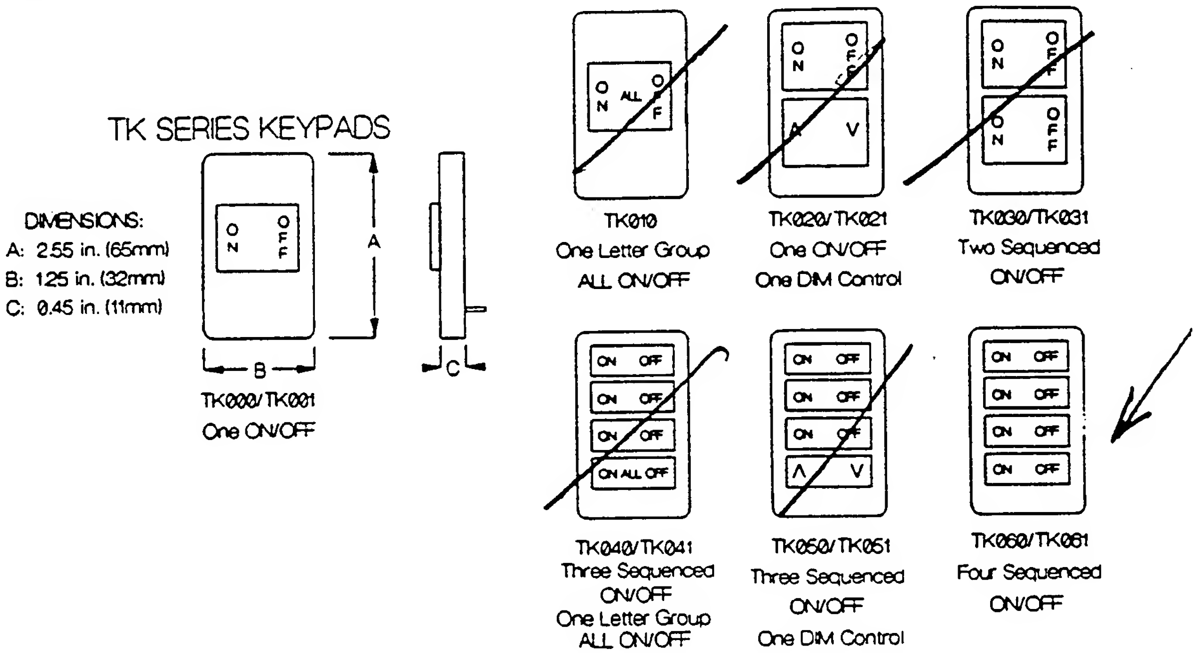
E: 1.4 in. (35.5mm)



H-37

TK SERIES

PCC Keypads for TB Series Transmitters



BEFORE YOU BEGIN...

READ ALL INSTRUCTIONS

Make sure your installation will conform to all applicable codes and requirements.

TEST FOR SIGNAL STRENGTH AND NOISE...

using the AR300 and the AT300. It is necessary to test the installation in the actual operating environment. The amount and types of line loads may reduce the strength of the transmitted signal and/or electrical noise may cause interference with the transmitted signal. Proper installation may require additional couplers, filters or repeaters. Special coupling devices are required to allow signal to be distributed to all phases and zero-crossings in multi-phase and multi-transformer distributions.

IF YOU HAVE ANY QUESTIONS...

Consult your nearest Engineered System Center (ESC) for additional information.

There are no field repairable assemblies on this unit. It is covered by a two year limited warranty. If service is needed, the unit must be returned to the ESC where purchased. Contact your ESC for return details.

INSTALLATION

CAUTION! Make all connections with the **POWER OFF** to avoid injury to the installer or damage to the device.

1. Set the address:

   Up to 256 addresses can be selected from the TB Series Transmitter. The address consists of a Letter Code (A through P) and a Number Code (1 through 16) for Unit address. Set the address code dials as shown in the Wiring Diagram for the TB Series Transmitters.

2. Slip the top of the TK Series Keypad into the notch at the top of the TB Series Transmitter. Align the pins on the TK Keypad with the sockets on the TB Transmitter and push in place.

3. Make sure the load or installation does not exceed the device rating.

4. Install the cover plate/trim ring (Decora TM or compatible style available through electrical supply vendors).

CHECKOUT

1. Restore the power.

2. Test Local Operation:

   TK000/TK001 - One Button Keypad - One ON/OFF Command:

   The ON/OFF rocker switch controls all loads (either On or Off) controlled by R Series Receivers that are set for the same complete address code as the TB Transmitter.

   Depress the rocker switch several times to ensure the module properly controls the load in response to manual control.

   TK010 - One Button Keypad - One ALL ON/ALL OFF Command:

   The ALL ON/ALL OFF rocker switch controls loads (either On or Off) controlled by R Series Receivers. The ALL ON command controls all RD, RF and RS Series Receivers (except those RS Receivers that do not respond to the "All Lights On" command) that are set for the SAME LETTER code as the TB Transmitter. The ALL OFF command controls ALL R Series Receivers that are set for the SAME LETTER code as the TB Transmitter.

   Depress the rocker switch several times to ensure the module properly controls the load in response to manual control.

   TK020/TK021 - Two Button Keypad - One ON/OFF Command, One DIM Command:

   The ON/OFF rocker switch controls all loads (either On or Off) controlled by R Series Receivers that are set for the same complete address code as the TB Transmitter.

   The ∧/∨ rocker switch Brightens (∧) or Dims (∨) ALL loads controlled by TD Series Dimmers that are set at the SAME Letter code as the TB Transmitter.

   Depress each rocker switch several times to ensure the module properly controls the load in response to manual control.

   TK030/TK031 - Two Button Keypad - Two Sequenced ON/OFF Commands:

   Each ON/OFF rocker switch sequentially controls all loads (either On or Off) controlled by R Series Receivers that are set for the same complete address codes (beginning and in sequence with) the address code set on the TB Transmitter.

   Example: if the TB Transmitter is set on B1, the top rocker switch will control all loads set at B1 and the next rocker switch will control all loads set at B2.

   Depress the rocker switch several times to ensure the module properly controls the load in response to manual control.

TK040/TK041 - Four Button Keypad - Three Sequenced ON/OFF Commands, One ALL ON/ALL OFF Command:

Each ON/OFF rocker switch sequentially controls all loads (either On or Off) controlled by R Series Receivers that are set for the same complete address codes (beginning and in sequence with) the address code set on the TB Transmitter.

Example: if the TB Transmitter is set on B1, the top rocker switch will control all loads set at B1, the second rocker switch will control all loads set at B2 and the third rocker switch will control all loads set at B3.

The ALL ON/ALL OFF (fourth) rocker switch controls loads (either On or Off) controlled by R Series Receivers. The ALL ON command controls ALL RD, RF and RS Series Receivers (except those RS Receivers that do not respond to the "All Lights On" command) that are set for the SAME LETTER code as the TB Transmitter. The ALL OFF command controls all R Series Receivers that are set for the SAME LETTER code as the TB Transmitter.

Depress the rocker switch several times to ensure the module properly controls the load in response to manual control.

TK050/TK051 - Four Button Keypad - Three Sequenced ON/OFF Commands, One DIM Command:

Each ON/OFF rocker switch sequentially controls all loads (either On or Off) controlled by R Series Receivers that are set for the same complete address codes (beginning and in sequence with) the address code set on the TB Transmitter.

Example: if the TB Transmitter is set on B1, the top rocker switch will control all loads set at B1, the second rocker switch will control all loads set at B2 and the third rocker switch will control all loads set at B3.

The ∧/∨ rocker switch Brightens (∧) or Dims (∨) ALL loads controlled by TD Series Dimmers that are set at the SAME Letter code as the TB Transmitter.

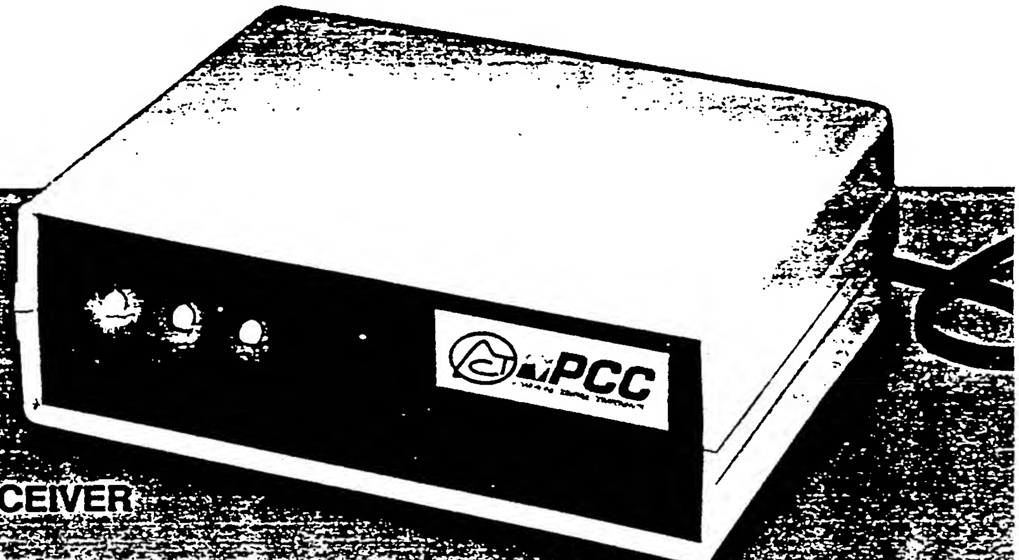
Depress the rocker switch several times to ensure the module properly controls the load in response to manual control.

TK060/TK061 - Four Button Keypad - Four Sequenced ON/OFF Commands:

Each ON/OFF rocker switch sequentially controls all loads (either On or Off) controlled by R Series Receivers that are set for the same complete address codes (beginning and in sequence with) the address code set on the TB Transmitter.

Example: if the TB Transmitter is set on B1, the top rocker switch will control all loads set at B1, the second rocker switch will control all loads set at B2, the third rocker switch will control all loads set at B3 and the fourth rocker switch will control all loads set at B4.

4. Test for Signal Strength and Noise once again using the AR300 and AT300.



PCC TU100 STAND-ALONE TRANSCEIVER

The ACT TU100 provides the user with a versatile, powerful transmitter that "stands alone" in performance. Versatile because it can be set up to handle load switching in many different ways. Powerful in that it can carry out an entire year of schedules unattended. Once programmed, it can stand alone and function detached from the user's computer.

The TU100 has an on-board microprocessor which functions independently after schedules have been entered. The clock/calendar allows a scheduling for time-of-day, day-of-week and month/date. Memory is protected from power failures for up to ten years by a lithium energy source. The memory accommodates up to a year's worth of scheduling.

The TU100 accommodates switching schedules for sixteen letter codes (A-P) each of which has sixteen number codes (1-16). The PCC receivers can use any of these 256 unique codes alone or with multiple receivers set on the same code.

Features:

- 100 groups with corresponding schedules
- 4 holidays per group - future release of software will have 12.
- Group Schedules provide for regularly occurring ON/OFF events each day of the week. Each Group Schedule can control from 1 to 256 point addresses. Holidays provide alternate schedules for one to sixteen days.
- Auto-Adjust Mode *

If selected, on return from a power interruption, the TU100 automatically reconciles all schedules to the current time and then carries out a "Refresh" sequence.

- Overrides

Each point address may be overridden indefinately to a particular time or for a specified period.

- 50/60 Hz selectability.
- P1 Test

On command, "P1 Test" transmits continuous P1 ON and P1 OFF signals for testing signal strength with the AR300 PCC Signal Strength Indicator.

- Visual Indicator

Three LED's indicate if the TU100 is powered, and whether it is sending or receiving signals.

- Computer Connection

The TU100 communicates with an external computer through its RS232 connector. Using your software or ours, you have all the power of your computer to set up, retrieve and print your schedules. Once programmed, the TU100 need not be connected to the external computer.

- Peripheral Connection

An RS485 connection is provided for input from ACT peripheral devices.

- Modem Connection

The TU100 can be connected directly to computers by a cable of up to fifty feet in length. For longer distances, the TU100 can be connected to an auto-answer telephone modem. When used with another modem at the computer end, communication with the TU100 can be accomplished anywhere there is a telephone outlet-around the block or around the world. The TU100 communicates at 2400 baud.

■ "User Friendly" Software

ACT provides software to communicate with the TU100 from an IBM PC or PC compatible computer. It supports the set-up of all desired schedule data and can control all functions of the TU100. It enables the user to write data to the TU100 memory or read it back, store and retrieve the data on the computer's floppy disc or provide hard copy from a printer. In addition, TU100 software supports modem operation, including phone number lists for auto-dial modems. Our software adjusts as the user's level of expertise increases. For beginners, everything is completely menu-driven. As operators become more experienced, the software supports direct typing of data without walking through the menus.

The ACT TU100 Operator's Manual comes with a complete description of the user interface and applications guidelines. A technical reference manual is available for those who choose to write their own software.

Applications

■ Dedicated Control

Since the TU100 can be commanded to transmit and receive PCC signals directly, it may be permanently connected to a PC computer or mainframe and work with the computer in real time. It may also be uploaded with schedules for a day, week, month or season at a time, and left connected but "off-line" for instant "on-line" communication at any time.

■ Set It and Forget It

Because the TU100 does not need an external computer for operation, it can be programmed for up to a year (longer if no data-dependent overrides are used or yearly repeating of overrides are used or yearly repeating of overrides is desired), then disconnected from the computer and installed at any 120 volt outlet that is on its own separate circuit or that has been examined and suitably coupled, if necessary, by the installer. Its small size allows it to fit under a counter or on a bookshelf. For reprogramming, just unplug the unit (the battery back-up keeps the schedules "alive") and bring it back to the computer.

■ Distributed Control

If the PCC installation has areas of electrical isolation from the PCC signal (which may occur if the building has several electrical feeds), more than one TU100 can be used. Each isolated area can then have 256 points of control and reduce the need for signal boosting and coupling services.

■ Remote Communication

The TU100 can be outfitted with an auto-answer modem. It merely requires a nearby telephone outlet jack for the modem. In fact, if several TU100s are in use, in one facility or across an entire chain of facilities, it is possible to communicate with all of them (one at a time) from a single central computer. When an installation is dialed up, the modem answers the phone and makes available the same power and versatility of a TU100 connected directly to the computer.

The following are some suggestions of how a dealer or service operator might use the TU100 as part of a package.

■ Programming Services

Since you can program the TU100 at the computer before installation, the dealer might rent use of his computer to a customer who has none or might sell the unit to the customer pre-programmed. The customer or the dealer would then install it.

■ Remote Operation

The dealer could control the operation of one or several installations. Using a customer-or dealer-owned TU100, the dealer can monitor each installation from his central computer. In this application, it would be possible to download schedule changes as necessary. In addition, troubleshooting of the system can be accomplished over the phone line.

Versatility: The ACT TU100, when integrated with proven PCC components, offers the building operator an unmatched level of cost-effectiveness and versatility. The adaptability of the TU100 combined with the wide diversity of available PCC components, lets managers expand or upgrade facility management capabilities easily, rapidly and inexpensively.

~~ADVANCED CONTROL TECHNOLOGIES, INC.~~ ~~Phone: 317-248-2640~~ ~~Toll Free: (800) 886-2231~~
1936-B South Lynhurst Indianapolis, Indiana 46241 07911 FAX: 317-248-6898

DDC

-METASYS-

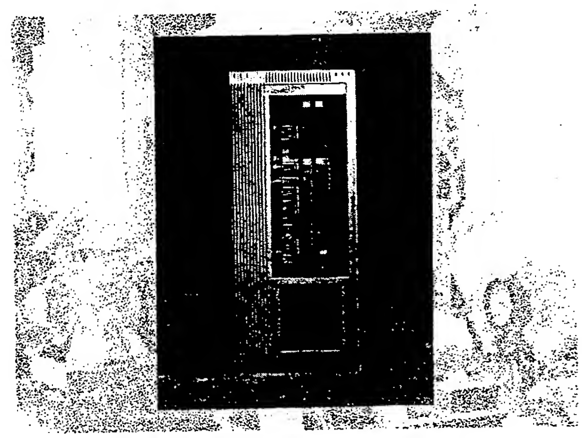
Network Control Unit, Network Expansion Unit

The Network Control Unit (NCU) is a modular, intelligent panel that is the heart of the Metasys™ Network. Use an NCU where complex, high-performance control is demanded, such as central plant heating, ventilating, and air-conditioning. The NCU also coordinates independent Application Specific Controllers (ASCs) over a communications network.

In a design breakthrough, the NCU integrates auxiliary electronic hardware into a family of modules that plug into a base frame chassis. Instead of piecing together diverse products on site, the auxiliary components are built-in at the factory. Result: lower total installation costs, greatly improved performance and efficiency, and simplified use.

The base frame also allows you to configure the panel from a selection of compatible modules. You can tailor a system precisely to the immediate application, while leaving options for easy expansion or retrofits in the future.

A companion product, the Network Expansion Unit (NEU), allows you to expand the I/O point and control loop capacity of the NCU. The NEU is a remote panel that communicates with the NCU over simple telephone wires.



Features and Benefits	
❑ Modular Design	Family of modules for economical installation, service, and future expansion.
❑ Molded, Hardened Packaging	Meets the structural and safety standards set by metal, but vastly reduces labor costs.
❑ Integrated Auxiliary Gear	Assembles field interfaces (pneumatic and electric) and electronic components into an integrated package for "single panel" installation savings and system reliability.
❑ Continuously Self-Tuning Proportional-Integral-Derivative Control Algorithm	Dynamically fine tunes—or changes—control strategy to improve performance and energy efficiency. Makes managing your facility simple.
❑ Manual Overrides / Status LED indicators	Local operator monitoring and control makes the system easy to use.
❑ Distributed Architecture	Multiple processor and power supply architecture shares and accelerates control processing ability, dispensing with a headend and improving the system reliability.

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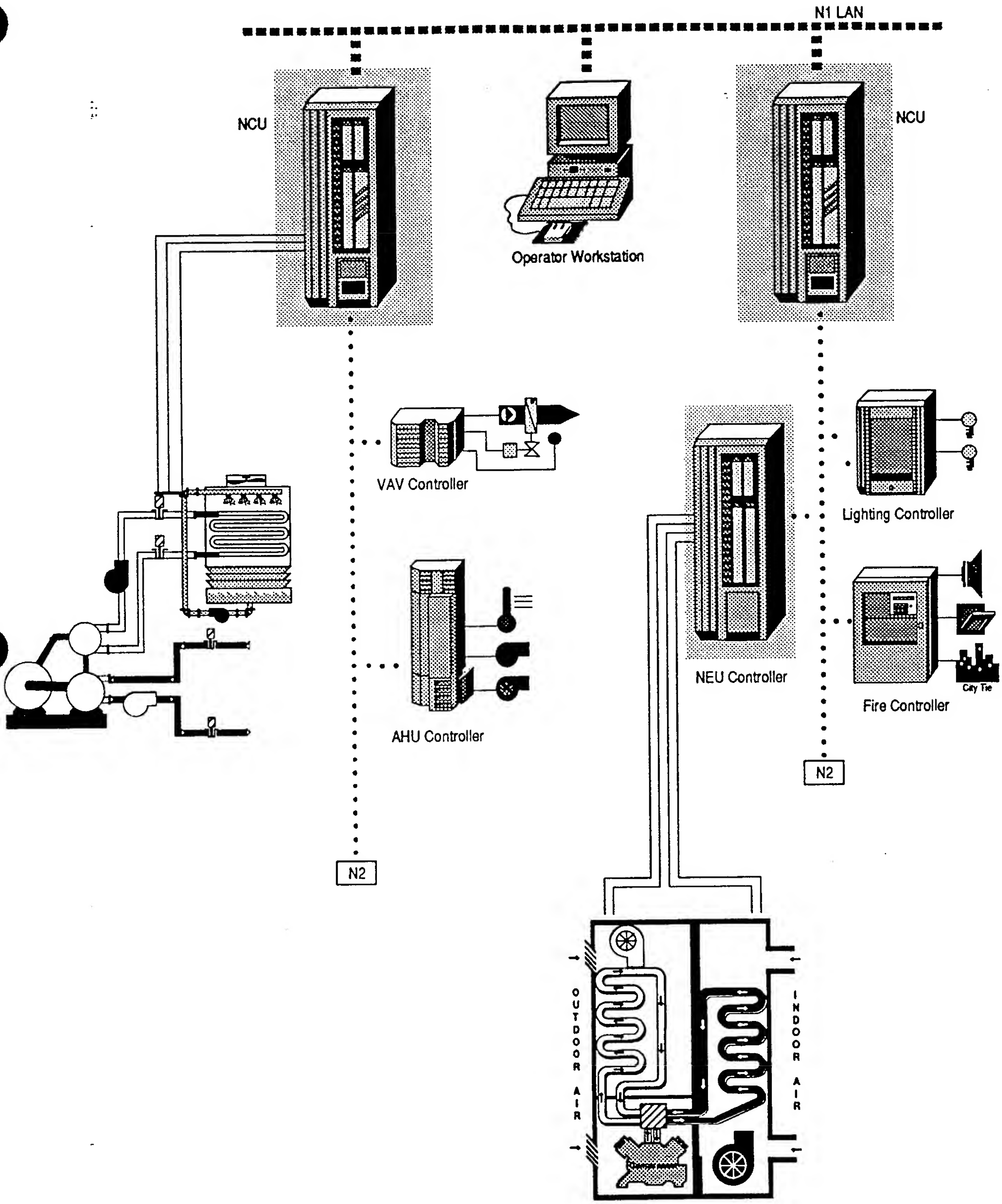

Figure 1: System With Two Network Control Units and One Network Expansion Unit

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Modularity for Multiple Applications

The NCU is a high-performance field panel configured from a family of compatible electronic, electrical, and pneumatic modules. This modularity allows the NCU to handle a wide array of control duties.

In small facility applications, an NCU serves as the main control panel. Its flexibility in connecting I/O points makes it the perfect controller for setting up and running all control applications. Using a combination of resident applications and custom user-written programs, the NCU operates equipment at peak efficiency while maintaining optimum occupant comfort. The NCU communicates to the building manager through local override controls, an easy to use Network Terminal, and local or remote graphic Operator Workstations and printers.

Medium and large facilities can use several NCUs, each of them controlling a portion of the facility. NCUs network together via the N1 LAN to share their information. Unlike other systems, this sharing is unlimited and allows any NCU access to any information available to any other NCU. More than just "peer-to-peer," the ease with which the N1 LAN allows complete information sharing is called Dynamic Data Access™. This is a breakthrough in Facility Management Systems, making practical the ability to totally integrate every facet of a building's operation on a single network.

By sharing all information with each other over the network, the NCUs are able to take advantage of sophisticated control algorithms to provide facility-wide optimization. Together, the NCUs make thousands of calculations—instantly—to determine the most efficient operations of such things as the chillers under the control of one NCU with the systems under the control of another.

The NCU can serve still another function: as the network operator interface. The NCU organizes information for operator reports and responds to that operator's commands and program changes. Since each NCU has total access to all NCU data on the N1 LAN, operator access through one NCU is the same as access to all NCUs.

The NCU also coordinates a local network of Application Specific Controllers (ASCs) as they perform HVAC, lighting, fire, and access control functions. In this application, the NCU provides alarm monitoring and integrated control functions for the standalone controllers.

Carrying out even one of these many functions would be a major accomplishment for many controllers, but the Metasys NCU handles them all with ease.

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Simple, Versatile System Access

The building operator has access to the entire Metasys Network through a family of operator interface devices attached to the NCU. Three ports are available for use by operator devices. One port is a standard RS-232 connection to which either an Operator Workstation or output printer may connect.

The second is dedicated to the Network Terminal—a portable or panel mounted input/output device. Like the Operator Workstation, the Network Terminal has access to all parts of the network. It is used for point monitoring, overrides, setpoint adjustments, schedule changes, and parameter modifications.

The third port houses either a dial-up modem module, or a standard RS-232 module that connects to an external modem. The modem module is a 1200 baud Hayes™-compatible auto-answer modem. This provides access to the entire network via remote monitoring by either an Operator Workstation or an output printer.

The NCU supports a multi-user environment, which means that any number of operators can be accessing information in the NCU at the same time.

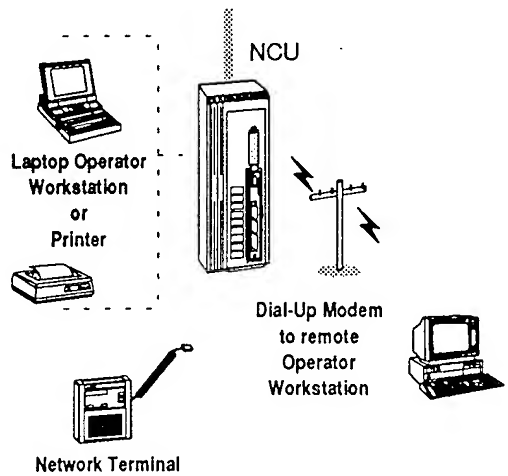

Figure 2: Multi-User Environment Options

Affordable Expansion—The NEU

The flexibility and modularity of Metasys enables facility managers to choose only the equipment they need to operate their buildings.

A good example of how this modularity saves money is the Network Expansion Unit (NEU). The NEU is a panel that, in appearance and I/O functions, is identical to the NCU. It differs only in that it lacks the NCU's main processor, the Network Control Module (NCM).

The NEU is an intelligent remote panel used to expand the point I/O and control loop capacity of the NCU. It is connected to the NCU over a simple 3-wire communication trunk, the N2 Bus. Installing an NEU is often more economical—and efficient—than hardwiring dozens of points from an equipment room back to the NCU in another part of the building.

This flexibility is one reason why Metasys is the preferred FMS solution for existing facilities looking for ways to modernize and optimize their operation. It also makes Metasys the perfect choice for new construction, since the system can be precisely tailored for the immediate application while still providing easy system expansion in the future.

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A Wide Variety of Enclosures and Base Frames For Total Customization

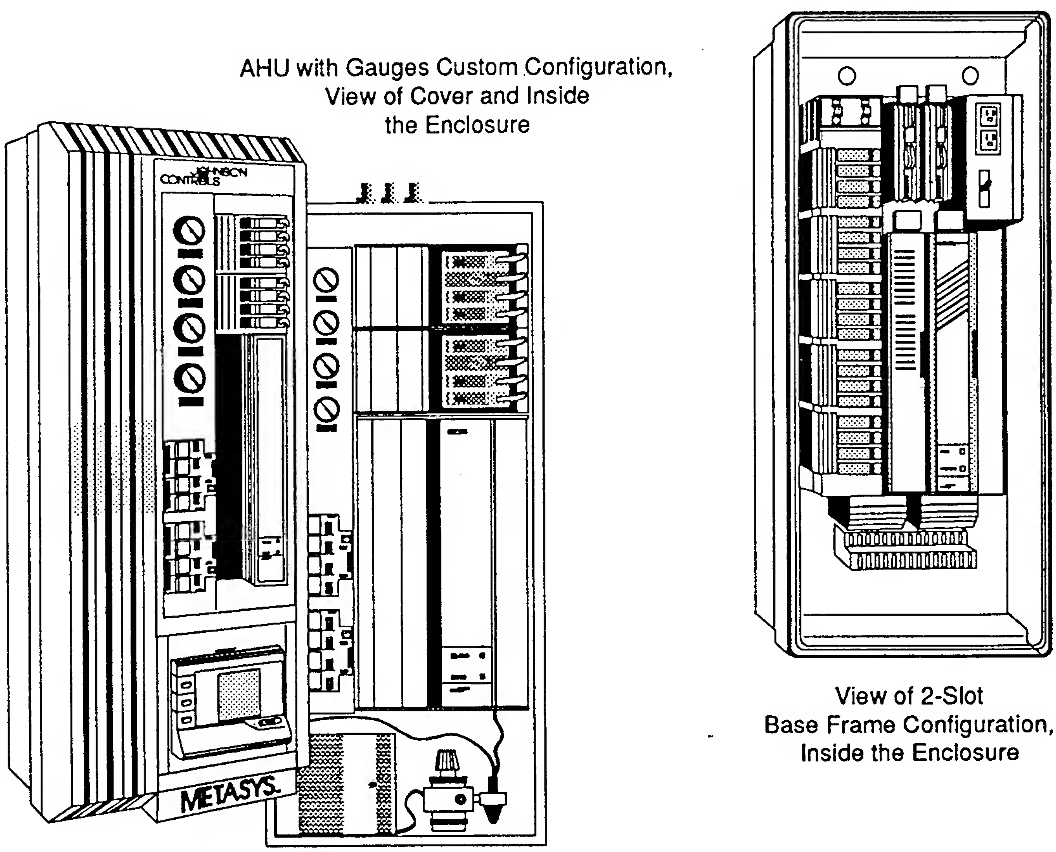
The physical design of the NCU and NEU was given as much careful thought as the rest of the Metasys system. NCUs and NEUs are configured from a family of electronic, electric, and pneumatic modules that fasten into a base frame. Each module has a magnesium and structural plastic case that protects internal electronics from electrostatic discharge during handling, or from airborne contaminants while in use. The metal case mates to a metal ground plate in the base frame, forming a continuous electromagnetic shield for all the electronics. Since each module already contains the shield it needs to perform reliably, adding future modules builds a faraday "box" on the fly, without the cost or planning necessary with traditional cabinets. It's this built-in protection that lets the NCU and NEU operate reliably, even in harsh, electrically noisy environments.

Three base frame sizes accommodate various numbers of modules and point I/O. For retrofit applications, you can mount the base frame and modules into an existing cabinet.

But for new construction, house the base frames in an attractive, thermally efficient Metasys enclosure—its transparent door allows keyed access to all operator override controls. And if you want, use a larger enclosure to house additional devices, such as application specific controllers, pneumatic cumulators, regulating valves, etc.

Subpanels, with standoffs, accommodate this mix and matched gear, and bring meters and gauges close to the transparent door for easy viewing. Use standard panels or design your own. Our Panel Unit in Poteau will even assemble and wire a custom configuration for you.

AHU with Gauges Custom Configuration, View of Cover and Inside the Enclosure



View of 2-Slot Base Frame Configuration, Inside the Enclosure

Figure 3: Enclosure With Customized and Base Frame Configurations

H-48

Designed for Economical Installation and Service

Installation accounts for 75% of the total cost of building controls. Instead of continuing the pattern of systems that individually wire diverse components, the Metasys family of modular components just plug into a standard chassis. These modules already contain the necessary relays, signal conditioners, overrides, and transducers that, individually, are expensive to wire together. By building in auxiliary functions, packaging them into modules, and joining them with plug-in connections, the Metasys base frame and modules can be installed or serviced without a single nut or screw. Changes? Simply plug in additions and replacements.

Installing an NCU or NEU is simple. First, mount an enclosure to claim wall space and land conduits for line-voltage wiring. After cables, wires, and pneumatic tubing are pulled, mount the base frame. The molded design of the base frame eliminates on-site labor by its snap-fit assembly and on-board gear; plus, its rigidity and light weight allow hanging of a complete system by one person, instead of the usual two.

Make all terminations into the NCU's fast-clamping screw terminators. Next, plug in the various modules housing the electronics, power supplies, control relays, transducers, etc. The staging of this modular installation facilitates the timely flow of material to construction projects, provides logical and obvious division of labor for the electrical and mechanical trades, and keeps the electronics off the construction site where they could get damaged or lost.

Once the panel is up and running, maintenance costs are also reduced. The enclosure's resistance to corrosion, and the material's consistent texture and color, eliminates plating and painting. Surface scratches will not mar the cover, and there is no opportunity for rust to develop.

You'll require less service because the integrated assembly builds-in reliability at the factory, instead of wiring it together in the field. And if you do need service, the modular format individually isolates and protects the components: severe misapplication interrupts service only at the easily-replaceable, low-cost module.

Modules—The Foundation of the NCU/NEU

There are five basic types of modules that mount inside an NCU (four inside the NEU):

- Network Control Module (Only in NCU)
- Digital Control Module
- Point Multiplex Modules
- Function Modules
- Power Supplies

The following pages detail the purpose and features of each module type. Together, inside an NCU or NEU, they provide outstanding control performance and reliability in a modular design that's easy to install and service. They combine a library of proven, powerful software features with user-programmed flexibility, making the NCU and NEU cost-effective for a wide variety of custom control applications.

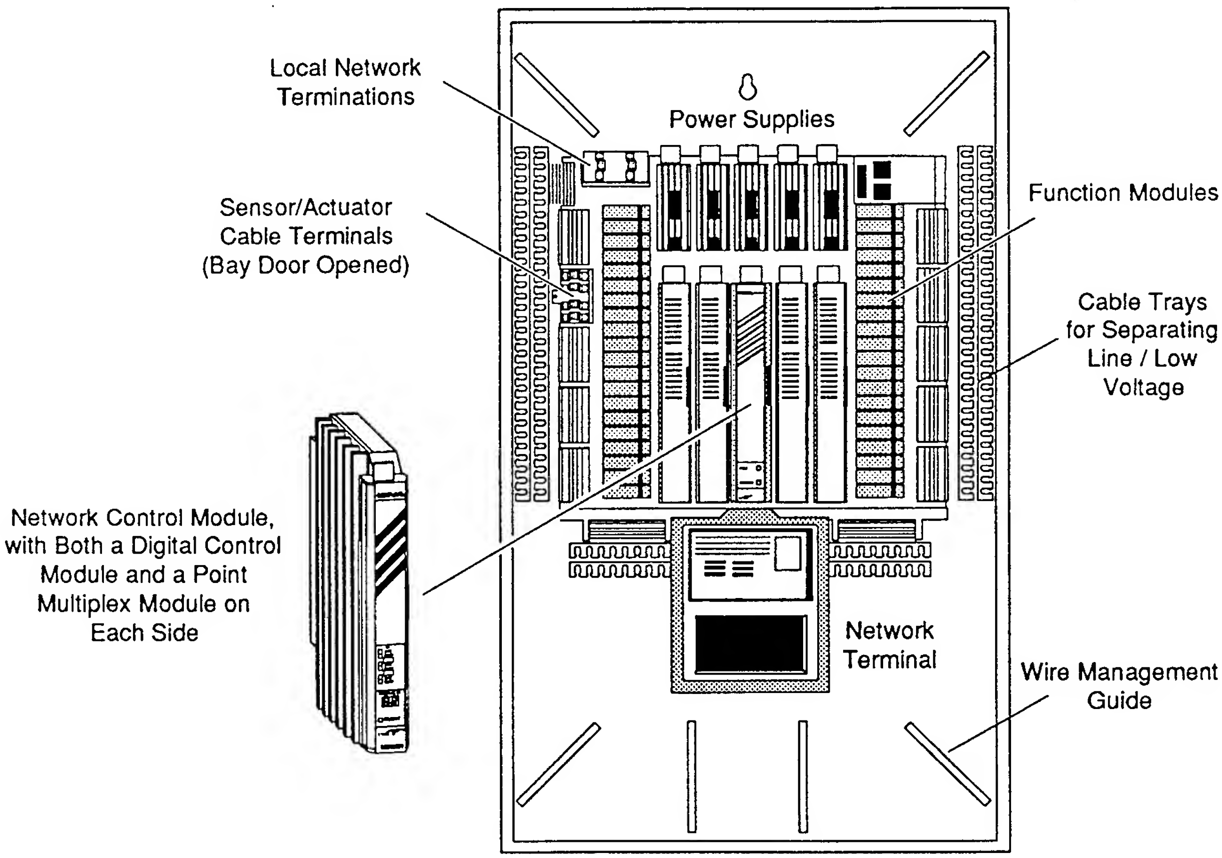


Figure 4: Modules of the Network Control Unit

Network Control Module

The Network Control Module (NCM) is the main processor in the NCU. Fully user-programmable, it is responsible for supervisory control activities for the points and control loops connected to the NCU and all NEUs and application specific controllers with which it communicates on its local buses.

You choose your NCM's configuration, whether as a standalone controller, a node on the N1 LAN working in concert with other NCMs, or as a connectivity path (bringing other systems under Metasys control or interfacing Metasys to a host system). The battery-backed memory of the NCM stores application programs, user data bases, and point histories. Every NCM includes the software features described in this section to coordinate system-wide efficiency, keeping you informed and in control while ensuring occupant safety and comfort.

Scheduling

Scheduling provides a long-term, system-wide means for issuing commands to points (e.g., on/off, or setpoint adjustment). Establish control on a time-of-day, day-of-week, or calendar basis. Virtually any number of commands may be scheduled per point.

Two types of weekly schedules can be defined: regular and alternate. These options give you the ability to create different on/off times for summer and winter. The NCM can automatically switch back and forth between these schedules based on either a date or an event, such as the outside temperature fluctuating around a limit. Holiday schedules can also be programmed to override the normal day-of-week programs. Up to 30 holidays, each lasting from 1 to 31 days, can be programmed up to a year in advance.

An Exception Program may also be scheduled up to a year in advance. This program overrides an individual point's weekly program on only the date for which it is scheduled. This allows those occasional changes to your normal building routines to be easily entered in advance, without the need to place your entire facility on holiday schedule.

Trending

Trending monitors changes in a point's value over time as a means to collect data when the system is operating properly, and to help diagnose problems in your facility.

Two different programs perform trending functions in the NCM. The first, Point History, keeps a running trend of every analog input point for the past 24 hours (one sample every 30 minutes), and a record of the last 10 changes for every binary input and all output points. For long term storage, point histories may optionally be uploaded from the NCM to an Operator Workstation. These histories are automatically available—should a building operator receive a note that an occupant's office was too hot, the operator can compare normal building operation data with the current information to diagnose problems in the facility. With this data automatically retained by the NCM, the operator can quickly resolve the problem and keep it from occurring again.

A second feature, User Trend, allows the building operator to create custom history files for selected points. For example, you may choose to trend various critical data values on a 1-minute basis and save all readings at the NCM for a week. Any number of points may be assigned to User Trend. As NCM memory becomes full, you can choose to automatically upload the oldest trends to any Operator Workstation.

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Totalization

Capabilities of the NCM include Run Time Totalization, which keeps track of total operation hours for fans, pumps, and other equipment monitored or controlled with a binary point. Analog Totalization and Pulse Totalization monitor the consumption of chilled water, steam, gas, electricity, or other variables measured by either analog or pulse input sensors. Event Totalization counts how many times something has occurred, such as a compressor cycling on and off.

The NCM maintains totalized values on an hourly, daily, weekly, or monthly basis. For longer term storage, these totals may be automatically uploaded to an Operator Workstation at the end of each totalization period. Of course, you can assign limits to any totalized value, generating an alarm or maintenance message when the limit is exceeded.

The number of points added to the Totalization feature is limited only by available NCM memory.

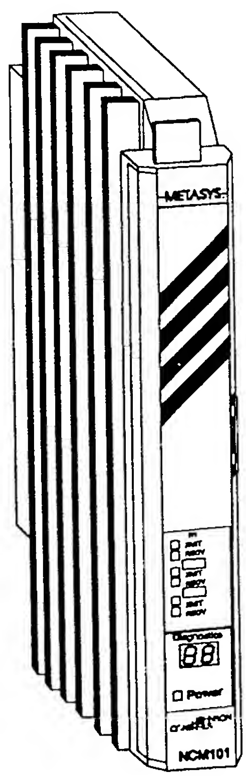

Figure 5: Network Control Module

Demand Limiting

Demand Limiting monitors your building's electrical meters and predicts what the electrical demand will be. Should the prediction exceed a target value, the feature temporarily turns off non-essential equipment. The *Load Rolling* feature cycles equipment on and off to reduce electrical power consumption. Both features are coordinated such that the equipment being turned on and off is evenly distributed throughout the building, avoiding "roller coaster" effects that occur when many loads cycle at the same time. In addition, space temperatures and other comfort indicators are constantly monitored to avoid turning off equipment that might result in occupant discomfort.

Each NCU can monitor up to four independent electric meters for demand control. However, the loads to be shed when needed can be located at any NCU on the network. Using Dynamic Data Access, all NCUs in your facility work together to coordinate energy control strategies.

Control Processes

User-written control processes allow programming of additional application features into the NCM. With the powerful Graphic Programming Language, even a non-programmer can write specialized programs for optimal start time control, night setback, outside air economizer programs, chiller plant optimization, and more. Enter these energy-saving programs from an Operator Work-station, then load them into the NCM over the N1 LAN, or through the direct RS-232 connection.

Password Protection

The NCM provides Password Protection. Each operator is assigned an eight character password ID. The ID is programmed to indicate which level of command authority will be granted, and which groups of points the operator has access to. The NCM maintains five levels of command authority and 16 user-defined point groups, such as HVAC, electrical, medical gas, and security. Up to 50 user passwords may be programmed. And once again, Dynamic Data Access coordinates between all NCUs and Operator Workstations such that the password information is consistent throughout the system. This means that each operator's password will work the same regardless of where the I/O device he is using is connected to the network.

Digital Control Module

The Digital Control Module (DCM) connects points to the NCU/NEU, and performs direct digital control of valves, actuators, variable speed drives, etc. The DCM is actually a coprocessor for the NCM, executing Proportional-Integral-Derivative (PID) loop calculations. This frees the NCM to perform duties such as scheduling, interlocks, and operation sequence. Each DCM supports up to ten universal input and ten universal output points. These points can be inputs and outputs for the DCM's PID algorithm, or they can be used independently for supervisory monitoring or control by the NCM.

You configure the PID algorithm in software, determining it as a proportional only, proportional plus integral, or proportional plus integral plus derivative controller. Applications include cascade or master/submaster control.

Furthermore, the PID algorithm is continuously self-tuning: after an initial setup, it automatically adjusts to equipment changes and load changes over time, without the need for manual recalibration. The result is service-free control with superior comfort and energy efficiency.

The PID algorithm also provides for both "softstart" and "bumpless transfer" control. This means gradually bringing chillers and fan systems into proper operating conditions at equipment start-up or manual-to-automatic changeover—without erratic cycling that can cause comfort problems, energy waste, and mechanical wear.

Building operators can monitor the performance of the PID control by use of the DCM's PID Diagnostic Trend feature. This feature samples the PID inputs and outputs every second, and makes the information available at an Operator Workstation in a graphical format. Control problems can be quickly identified and corrected.

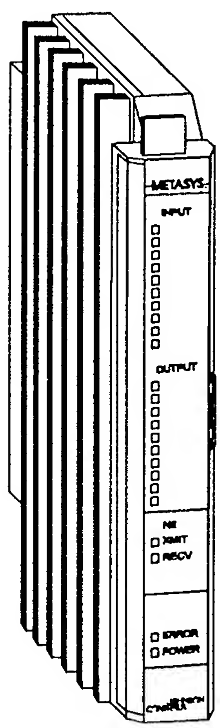

Figure 6: Digital Control Module

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Function Module

Function modules connect the sensor input and control output points to the DCM.

A variety of input function modules exist to provide signal conditioning and protection for the electronics of the DCM. Each input function module can process one—or a combination—of these signal types:

- Pneumatic, including a wide range of differential pneumatic signals
- Binary, dry contact or 120 VDC/VAC
- Voltage, 0 - 10 VDC or 120 VDC/VAC
- Current, 4 - 20 mA
- RTD Elements, both 1000 and 100 ohms

A variety of output function modules convert the electronic signals of the DCM into signals directly capable of controlling motor starters, actuators, etc. The types of output control signals include:

- Pneumatic, 1 - 19 PSI
- Voltage, 0 - 10 VDC
- Current, 4 - 20 mA
- Electrically isolated, if a ground reference is in the controlled device
- Binary, for 2-wire, incremental devices
- Triac, to control 24 VAC for 3-wire incremental devices
- Solenoid, for 2-position or switching control of pneumatic circuits
- Relay, including electrically maintained, magnetically latched, or momentary

The output function modules have manual override controls to allow the building operator to directly control both binary and analog outputs. These manual overrides are constantly monitored by the DCM—use of one is immediately reported to the system operator. The reporting mechanism prevents temporary overrides from becoming permanent, which could compromise energy management plans.

If the output is part of a PI or PID control loop, switching the output into "Manual" also puts the control loop into a tracking mode. The DCM monitors the controlled variable so that it can gracefully bring the output back into control when it is eventually placed back into "Automatic" mode. This feature provides a bumpless transfer of control from manual to automatic modes.

Using function modules makes the DCM compatible with a large variety of sensor and control output types, both electric and pneumatic. In addition, the robust design of the DCM electronics virtually eliminates the need for shielded cable in all but very electrically noisy environments. This means retrofit applications are cost effective for NCUs and NEUs, since most of the building's existing sensors and actuators can be reused.

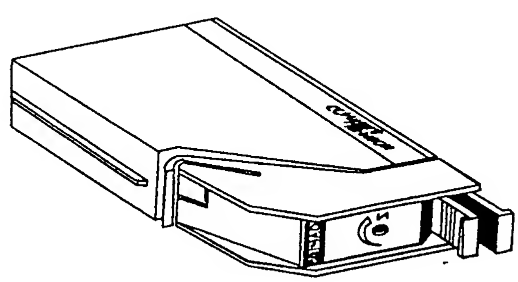

Figure 7: Function Modules Plug into an NCU or NEU

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Point Multiplex Modules

The Point Multiplex Modules (XM) economically interface points used for monitoring or supervisory control applications. They are perfect for adding point capacity in applications where the power and sophistication of a DCM is unnecessary.

Unlike the DCM, which has universal inputs and outputs characterized by function modules, each XM has a fixed input/output point configuration. All line-voltage relays, manual override controls, and other signal conditioning circuitry are housed with the electronics inside the XM. A family of XMs is available, differing only in point I/O mix. The next two charts index the capabilities of each XM.

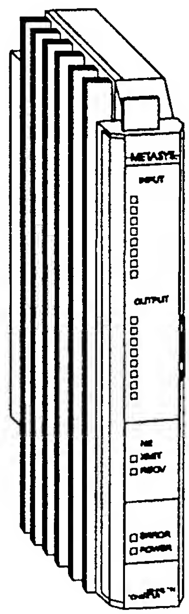

Figure 8: The XRE of the Point Multiplex Family

Chart 1: Input-Only Point Multiplex Module

	Multiplex Binary (XBN)
Method	32 inputs monitoring: - Dry contacts - AC - DC - Frequencies of 10 Hz or less
Indicators	32 LEDs (software configured) Point status change reports to NCM
Applications	Monitors the status of 2-position devices such as fans, pumps, or security panels. Voltage input from a starter or pilot device can also indicate that the equipment has changed state. In addition, the XBN can detect pulses from flow meters, electric utility meters, or other pulse output devices whose frequency is 10 Hz or less.

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Chart 2: Input/Output Point Multiplex Modules

	Multiplex Relay Electrically Maintained (XRE)	Multiplex Relay Latched (XRL)	Multiplex Relay Momentary (XRM)
Method	8 inputs: Same as XBN. 8 outputs: Electrically maintained Form C relay outputs.	8 inputs: Same as XBN. 8 outputs: Latching Form C relay outputs.	8 inputs: Same as XBN. 8 outputs: Momentary relay outputs, each with a set of Form A and Form C contacts.
Control Type	2-wire control	2-wire control	3-wire momentary control
Power Failure	The starter circuits de-energize; upon power restoration, the equipment does not immediately restart and cause a surge in demand. The user instead restarts safely and orderly via software commands.	The relay stays in the last position commanded—much like a light switch—even after loss of power.	The starter circuits de-energize; upon power restoration, the equipment does not immediately restart and cause a surge in demand. The user instead restarts safely and orderly via software commands.
Applications	Large air handler fans, large pumps, and other 2-wire devices that require a controlled startup after AC power loss.	Exhaust fans, which require minimal power and would be time consuming to manually restart; enabling circuits, for equipment under separate panel control; or other 2-wire devices that restart immediately after power returns.	Motors, pumps, pulse-on / pulse-off lighting contactors, and other 3-wire devices that require a controlled startup after AC power loss.

Power Supply

A power supply module (one for each electronic module) regulates and filters incoming line-voltage and protects against brownout. To reduce your spare parts inventory, the same model of power supply services all electronic modules.

The advantage of separate power supplies is that they simplify service—you can turn off the power for one module while leaving all other modules in the NCU or NEU fully operational. Multiple power supplies also increase your system's reliability by eliminating noise propagation between the electronic modules.

Since these modules supply power not only to the electronic module itself, but also to all sensors, transducers, and relays connected to that module, they eliminate the need and cost of additional external supplies for the instrumentation.

Finally, the power supply is equipped with the necessary logic to stage a startup: when power switches on, the power supply protects data integrity and eliminates cycling outputs or false alarm reports.

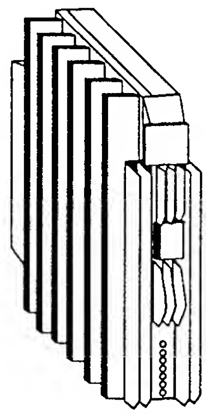

Figure 9: Power Supply Module

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Notes:

Specifications

Product	Network Control Unit, Network Expansion Unit
Power Requirements	85 - 264 VAC at 50/60 Hz
Ambient Operating Conditions	32° to 122°F (0° to 50°C) 10 to 90% RH
Ambient Storage Conditions	-40° to 158°F (-40° to 70°C) 5 to 95% RH
Dimensions (H x W x D)	*10" x 28" Enclosure-With-Cover (EN-EWC100-0)* 10 in x 28 in x 8.5 in (26 x 72 x 22 cm) (Fits 1-Slot Base Frame) *16" x 38" Enclosure-With-Cover (EN-EWC200-0)* 16 in x 38 in x 8.5 in (41 x 97 x 22 cm) (Fits 1-Slot or 2-Slot Base Frame; auxiliary gear with both configurations) *26" x 48" Enclosure-With-Cover (EN-EWC500-0)* 26 in x 46 in x 8.5 in (67 x 118 x 22 cm) (Fits 1-Slot, pair of 1-Slots, 2-Slot, or 5-Slot Base Frame(s); auxiliary gear with all configurations)
Processor	*Network Control Module:* 80386 @ 16 mHz (NCM200); 80186 @ 8mHz (NCM100 series) *Digital Control Module:* 80188 @ 8 mHz *Point Multiplex Modules:* 8051 @ 11 mHz
Agency Compliance	FCC Part 15 Class A; UL 916: CSA C22.2 #205
Agency Listings	UL Listed and CSA Certified

JOHNSON CONTROLS

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-METASYS-

Air Handling Unit Controller

The Metasys™ Air Handling Unit (AHU) Controller is a complete digital control system for most common air handling configurations, including single zone, variable air volume, multi-zone, and dual duct. The AHU Controller is designed to reduce energy expenses while keeping occupant comfort its top priority, and meets both goals admirably.

The AHU Controller has both hardware and software flexibility to adapt to many control variations in both new construction and retrofit applications. It can communicate on the Metasys N2 Bus, seamlessly providing all point and control information to the rest of the network. In a smaller facility, the AHU Controller is the perfect standalone controller. In either case, the AHU Controller, like the rest of Metasys, is simple to operate—and simply outstanding at providing efficient control and management of your facility's mechanical systems.

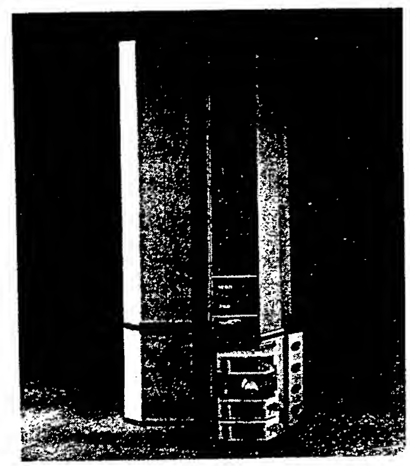

Figure 1: Air Handling Unit Controller

Features and Benefits	
❑ **Standalone Control of Each Air Handling Unit**	System reliability
❑ **Network Communications Over N2 Bus**	Facility-wide control efficiencies and cost effective sensor sharing
❑ **Fully Integrated Modular Packaging**	Purchase only needed parts
❑ **Complete Line of Compatible Sensors, Actuators, and Accessories**	Total system solution
❑ **Interfaces to Both Pneumatic and Electric Actuators**	Low cost installation for both new construction and retrofit applications

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Modular Hardware Packaging

The AHU100 has a family of compatible components that make it ideal for field installation. The basic controller itself has three parts. The Base Module mounts easily to any surface using either a DIN rail or direct mount. It provides screw terminations for system inputs and outputs. All electronics are on a separate circuit board that plugs into the base, which provides easy servicing and protection of the electronics during initial installation. A cover attaches to the Base Module, completing the enclosure.

Additional components can be added as required to complete the control system. A Transformer Kit mounts on the same DIN rail as the Base Module, providing 24 VAC power for the entire AHU100 system, plus a convenient connection point for conduit that might be used for the line voltage wiring or low voltage sensor cables.

A Line Voltage Relay Kit added to the DIN rail provides pilot duty switched outputs. Each Relay Module contains four SPDT relays, each of which can be controlled by any of the AHU Controller's binary output points. Each relay also includes a manual Hand-Off-Auto switch for local overrides. The HOA switches can be monitored by a binary input on the AHU Controller to annunciate to an operator whenever an output has been placed in the "hand" or "off" positions.

One or more Function Module Kits can also be attached to the DIN rail. Each houses from two to four function modules, which provide the AHU Controller with direct connection to pneumatic actuators, differential pressure inputs, and pneumatic transmitters.

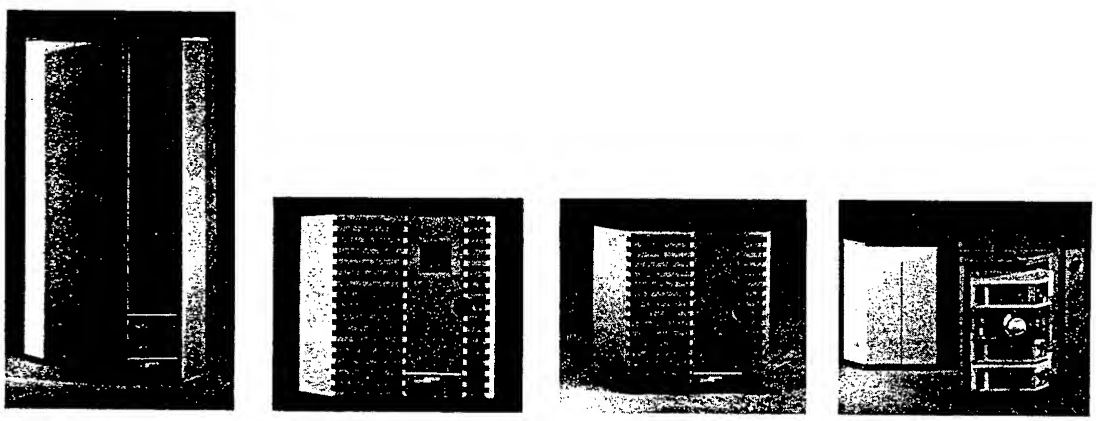

Figure 2: Base Module, Transformer Kit, Line Voltage Kit, Function Module

Components

Described below are the Controller Enclosure Kit, Controller Board, and a family of compatible devices. The system may be configured for any combination of electric or pneumatic requirements. A DIN rail provides the mounting foundation for the components (direct wall-mounting is also an option). No separate cabinet is required to house the system; however, a cabinet is available when required.

Controller Enclosure Kit (AS-AHU101-0)

The Controller Board plugs into this housing, and it is where all field and local terminations connect (shielded cables are not required). The enclosure also provides an optically isolated power supply for the N2 Bus and a phone jack to connect a laptop PC to the Zone Bus. The enclosure is shipped separately from the Controller Board to accommodate easier rough-in procedures.

Cable connections are available for the Power Supply/Transformer Module, Line Voltage Relay Kit, and OAP Function Modules.

Controller Board (AS-AHU102-0)

The Controller Board plugs into the enclosure. The AHU102 is temperature rated for equipment room application. Both versions process 16 inputs and 16 outputs, directly wired, as shown in Table 1.

Table 1: Sensors and Actuators

Point Type	Quantity	Characteristics
Analog Inputs	8	Jumper selectable for the following types: 0 to 10 VDC from any type of transmitter, range adjustable (0 to 5 VDC, 1 to 2 VDC, etc.) 4 to 20 mA from any type of transmitter, (range adjustable) IAP Function Module (0 to 25 psi) IDP Function module (0 to 10.0 in wg, 7 ranges) Resistance, (1000 ohms nominal) from nickel, 1000 ohm platinum sensors, or silicon temperature sensors
Binary Inputs	8	0 to 15 VDC, dry contact, TTL compatible
Binary Outputs	10	24 VAC Triacs @ 0.5 amps Optional Relay Kit (AS-RLY100-0) available for 240 VAC @ 5 amps.
Analog Outputs	6	0 to 20 mA to any type of receiver or to the OAP Function Module. Output zero and span are adjustable. 0 to 10 VDC (using a 500 W resistor) to any type of actuator, range adjustable. Optional zone bus for up to six M100CGA-2 actuators, which duplicate the analog outputs.

When connected to a Metasys Network or Metasys Companion, the Controller Board communicates to the system via the N2 Bus.

Whether in a network or standalone configuration, communications to the laptop PC and digital actuators are via the Zone Bus.

Zone Terminal (AS-ZTU100-0)

The Zone Terminal (ZT) is a person/controller interface developed as an easy-to-use controller adjustment and indication device. The ZT is designed for the user who needs a straightforward method to monitor and adjust points in an HVAC zone. The ZT plugs directly into the AHU Controller, or it may be used at any remote Zone Bus location through a Function Module Kit or Relay Kit.

The ZT can also be permanently connected to an AHU Controller by mounting the unit on a nearby wall or directly into the tower. The dedicated ZT provides alarm indication and scheduling for the controller, thereby completing the standalone AHU Controller strategy.

Function Module Kit (AS-FMK100-0)

The Function Module Kit provides the enclosure and termination board to connect up to four, single-slot Function Modules (FMs) to the AHU. The applicable modules (ordered separately) may be from any mix of IAP, IDP, or OAP FMs (see below). Tubing connections and field terminations are simple due to the tubing management trough. Multiple kits may be used per controller, limited by the controller's input/output capacity.

The kit mounts either below the AHU enclosure or remotely; when mounted remotely, a phone jack on the kit extends the controller's Zone Bus to allow easy setup and troubleshooting by the laptop PC from the remote location.

IAP 101-0 Input Pressure to Electrical Analog

The IAP is for a pneumatic transmitter interface, converting input air pressure (0 to 25 psi) to an analog signal range (4 to 20 mA). It occupies one slot in the FMK100-0 Kit, and is identical and interchangeable with IAPs used for other Metasys devices.

The separately ordered Pneumatic Connector Module (FM-PCM101) provides rough-in port connections for the tubing, then plugs into the IAP at commissioning.

IDP Series Static or Velocity Pressure Transducer

Each IDP Function Module converts static or velocity pressure (range depends on the particular IDP type) to a 4 to 20 mA analog signal. It occupies one slot in the FMK100-0, and is identical and interchangeable with IDPs used for other Metasys devices.

The separately ordered Pneumatic Connector Module (FM-PCM101) provides rough-in port connections for the tubing, then plugs into the IDP at commissioning.

OAP103-0/102-0 Analog Electrical Output to Air Pressure

The OAP is a pneumatic transducer that accepts a 0 to 20 mA analog signal from the controller and provides a corresponding air pressure output (user set from a 0 psi base). It occupies two contiguous slots in the FMK100-0. Cable connections are provided using an optional cable kit (screw type terminal connections are used when the FMK100-0 is remotely mounted).

The OAP102-0 is an insert module, attaching to the OAP103, that supplies rough-in port connections for the OAP103 tubing. The OAP102 additionally provides a local Auto/Manual switch, which can be wired back to a binary input at the controller to inform the Metasys Network of the switch status. The OAP102-0 is ordered separately.

Relay Module (AS-RLY100-0)

The Relay Module contains four SPDT, line voltage relays (Form C), a circuit board, override switches, and a metal enclosure. Conduit knock-outs are provided on the relay enclosure for both low and line voltages. A phone jack in the module provides communications to the laptop PC by extending the Zone Bus.

The replaceable relays are UL/CSA approved and have an output rating per relay of up to 250 VAC at 5 amps AC inductive. Each relay has an LED to indicate an energized state and a Hand-Off-Auto switch to provide local control. The Hand-Off modes can be wired back to a binary input at the controller to supply manual override status information to the Metasys Network.

When the Relay Module is installed next to the controller, cable kits are available to connect the controller's binary outputs to the Relay Board. When the module is remote from the controller, connections are made with discrete wiring, using screw terminals.

Multiple Relay Modules may be connected to a controller. In addition, jumper connections can operate multiple relays per controller binary output (e.g., 3PDT action).

Power Supply/Transformer Module (AS-XFR100-0)

This module is a 120 VAC to 24 VAC step down transformer, rated at 100 VA. It is UL/CSA approved and supplies power for all modules connected to the controller system.

The module enclosure includes a convenience outlet for 120 VAC, multiple conduit knock-outs for low voltage wiring, and a separate line voltage compartment and conduit knock-out for line voltage wiring. Included is a 3-pin plug to connect 24 VAC to the controller termination board.

Note: If M100CGA-2 electric actuators are added to the configuration, they require a separate power source. All other loads, including relays, are supplied by the XFR100 (up to 84 VA).

Utility Enclosure Kit (AS-ENC101-0)

The Utility Enclosure Kit houses the Zone Terminal as part of a tower configuration or other miscellaneous devices when they are necessary. The kit uses the same enclosure as that for the Relay Module and Power Supply/Transformer Module.

Convenient Configuration Setup

The AHU Controller does not need to be programmed in the traditional sense. Instead, the control algorithms and input/output point assignments are configured with the use of the HVAC PRO software tool. The HVAC PRO runs on a laptop computer plugged directly into the AHU Controller or into a jack at the connected room sensor. These jacks are connected back to the AHU Controller over a simple twisted pair cable called a Zone Bus. Programs loaded into the AHU Controller are saved in nonvolatile EPROM memory, so there is no need to reload software after a loss of power.

Programming an AHU Controller is a simple matter of responding to a series of "yes/no" and multiple choice questions, and specifying setpoints and other parameters. No previous software programming experience is required. The AHU Controller has a library of proven control sequences and proportional-integral-derivative algorithms that are automatically configured into a total system sequence-of-operation in response to your answers to the questions.

Once configured, the AHU Controller's operating parameters, such as setpoints, gains, alarm limits, and so forth, may be changed from any Metasys operator device.

Standalone Configuration

The controller connects to function modules, relay kits, and the Zone Terminal using discrete wiring, whether those modules are mounted adjacently or remotely. The Zone Bus accommodates daisy chain, star, or combination configurations for M100CGA-2 or laptop PC connections.

Access to the standalone AHU system is through the laptop PC or Zone Terminal, which connects to a phone jack on the controller termination board. Phone jacks are also mounted on function module kits and relay kits, extending the Zone Bus when kit locations are remote.

Using the HVAC PRO software, an operator configures, commissions, and diagnoses the entire standalone system.

Figures 3 through 6 show the arrangement of different AHU installations: an all-electric installation, an all-pneumatic installation, a combination installation, and an installation using remote function modules and relays.

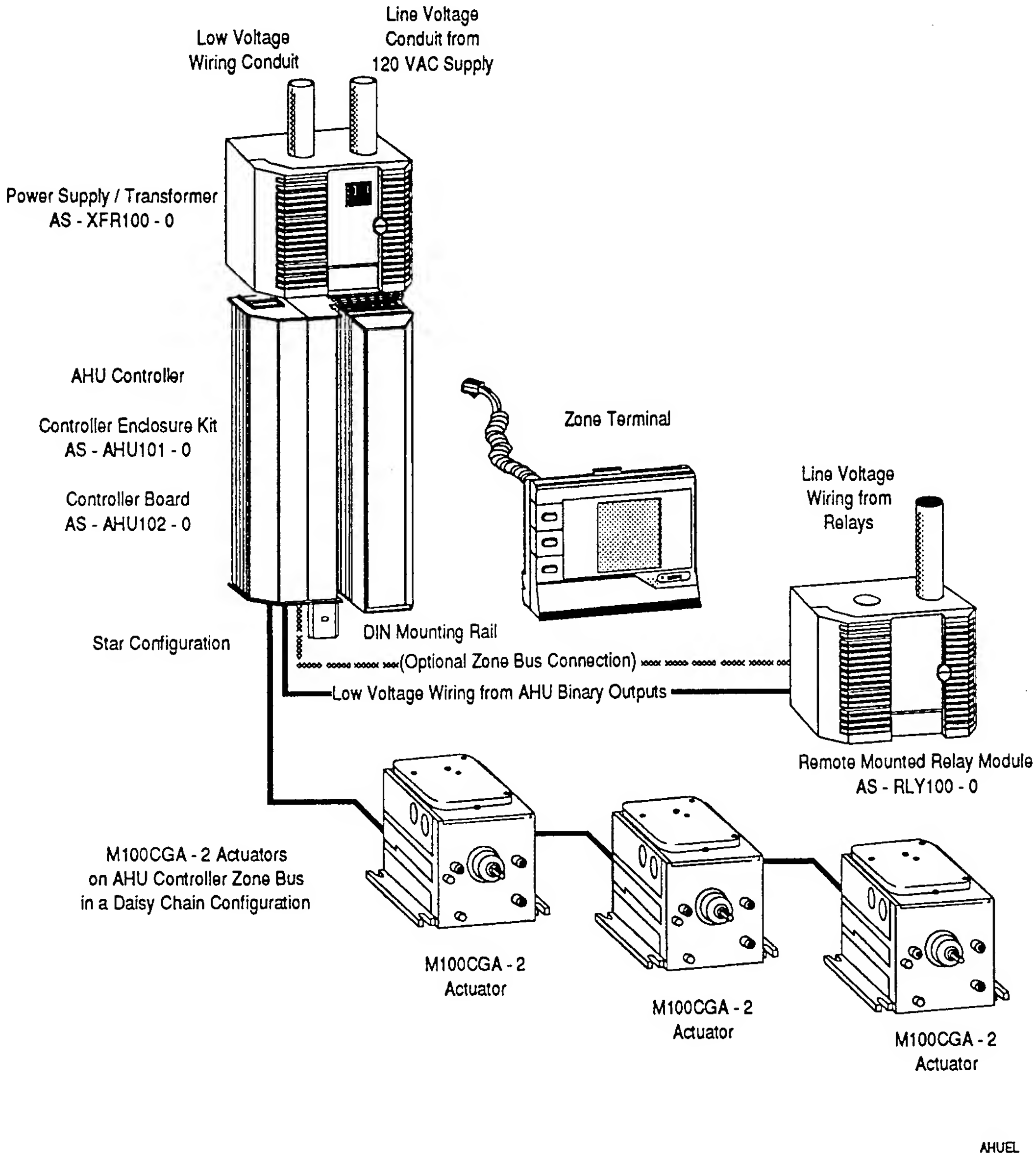

Figure 3: AHU Controller Electric Installation

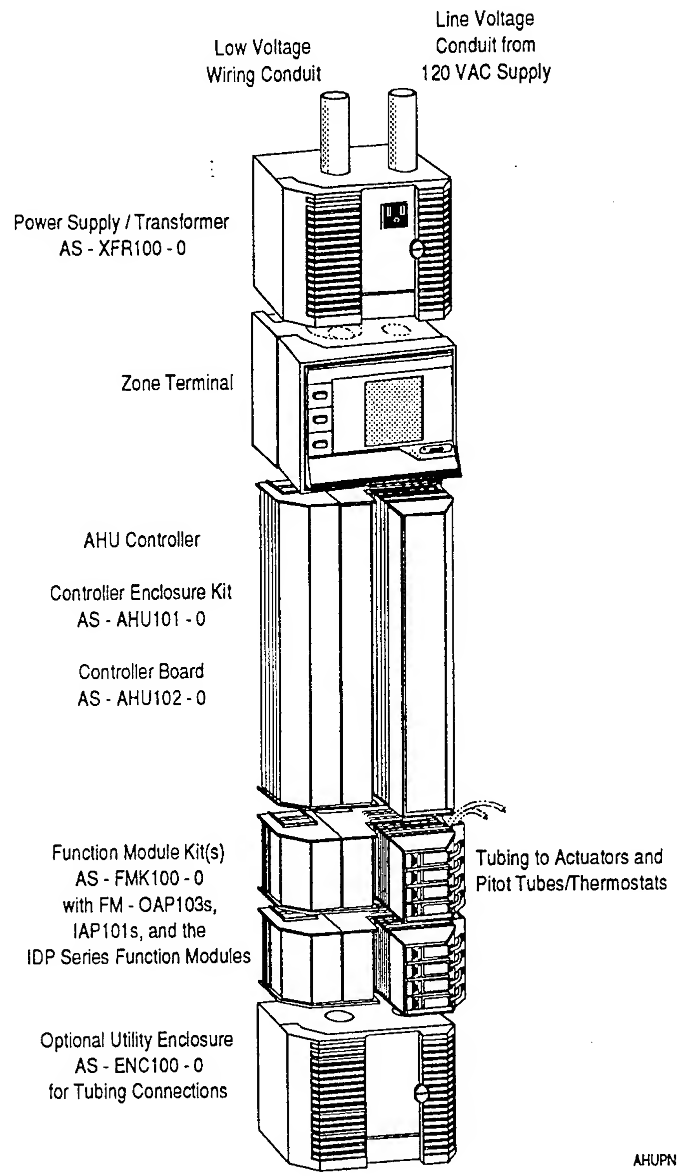

Figure 4: AHU Controller Pneumatic Installation

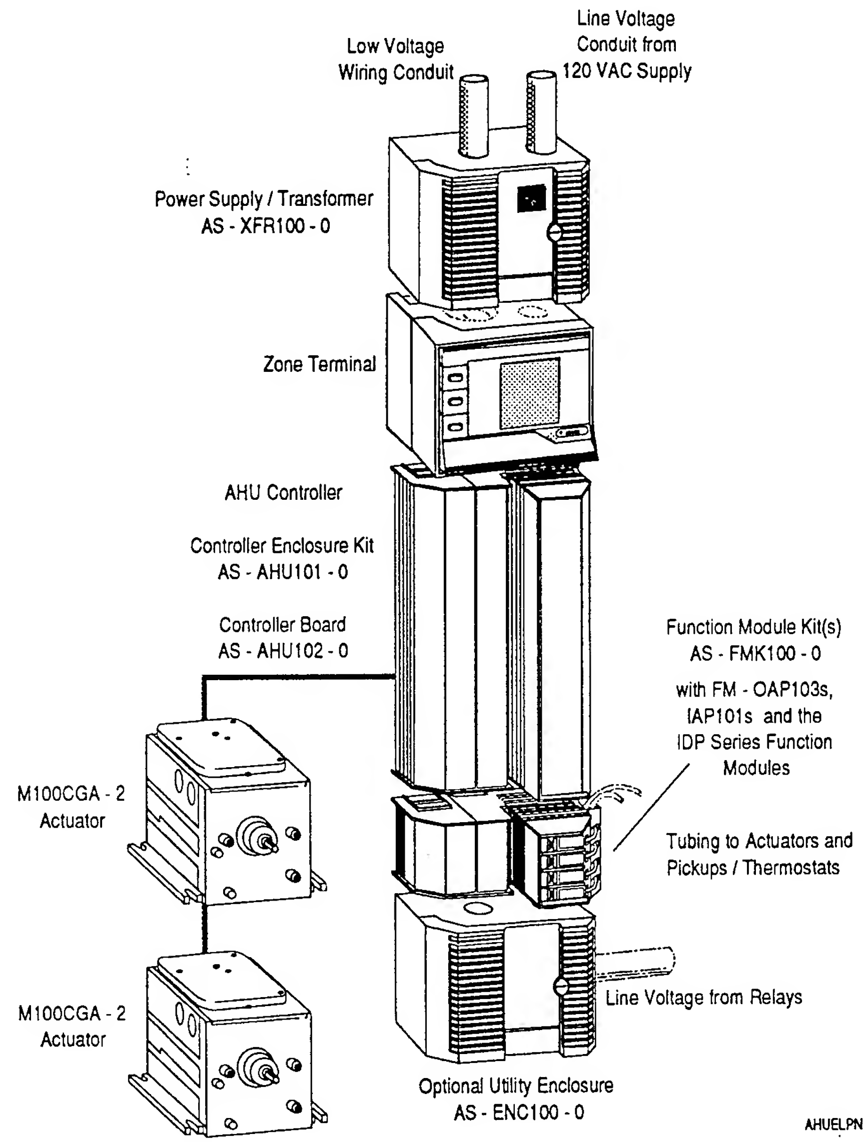

Figure 5: AHU Controller Electric/Pneumatic Installation

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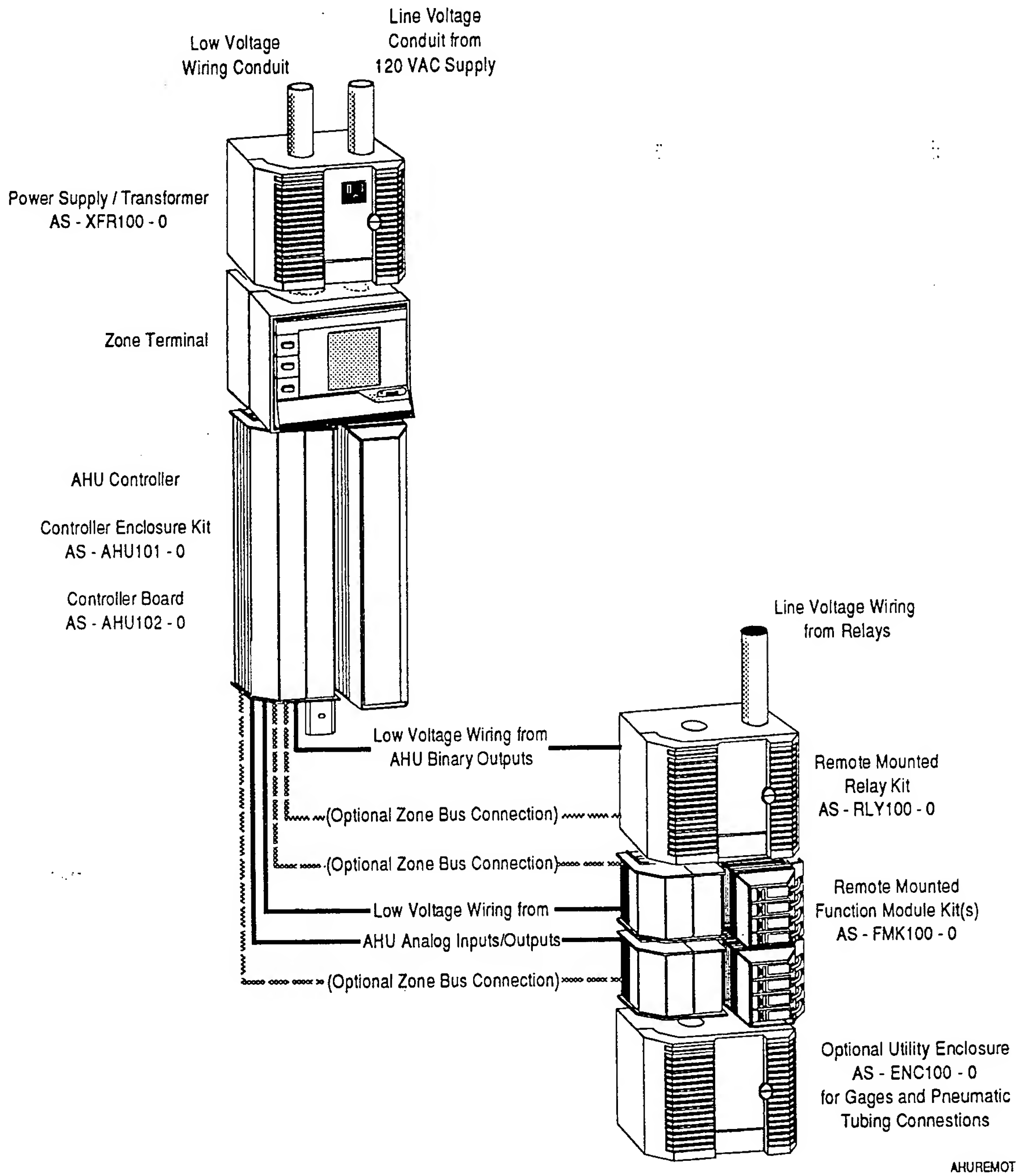

Figure 6: AHU Controller Installation With Remote Function Modules and Remote Relays

Metasys Network Configuration

As powerful as the AHU Controller is by itself, your facility will benefit even more when AHU Controllers are part of a larger Metasys network. Each AHU Controller can connect to the Metasys N2 Bus (Figure 7). Either a Network Control Unit or Companion System can be programmed to provide added energy management and supervisory control capabilities, including optimal start, demand limiting, load rolling, run time totalization, and more.

The Metasys Dynamic Data Access™ networking software, available from the Network Control Unit, makes all information from each AHU Controller available throughout the facility, so that it is possible, for example, to reset chiller or boiler temperatures based on the load demands of the AHU Controllers. Locally, HVAC control for the AHU is still handled by the HVAC PRO software, which interfaces with Metasys.

The full functions of the Operator Workstation and Network Terminal apply to the AHU: displaying values, setting points, and changing parameters. An optional laptop PC is the local operator interface to the AHU.

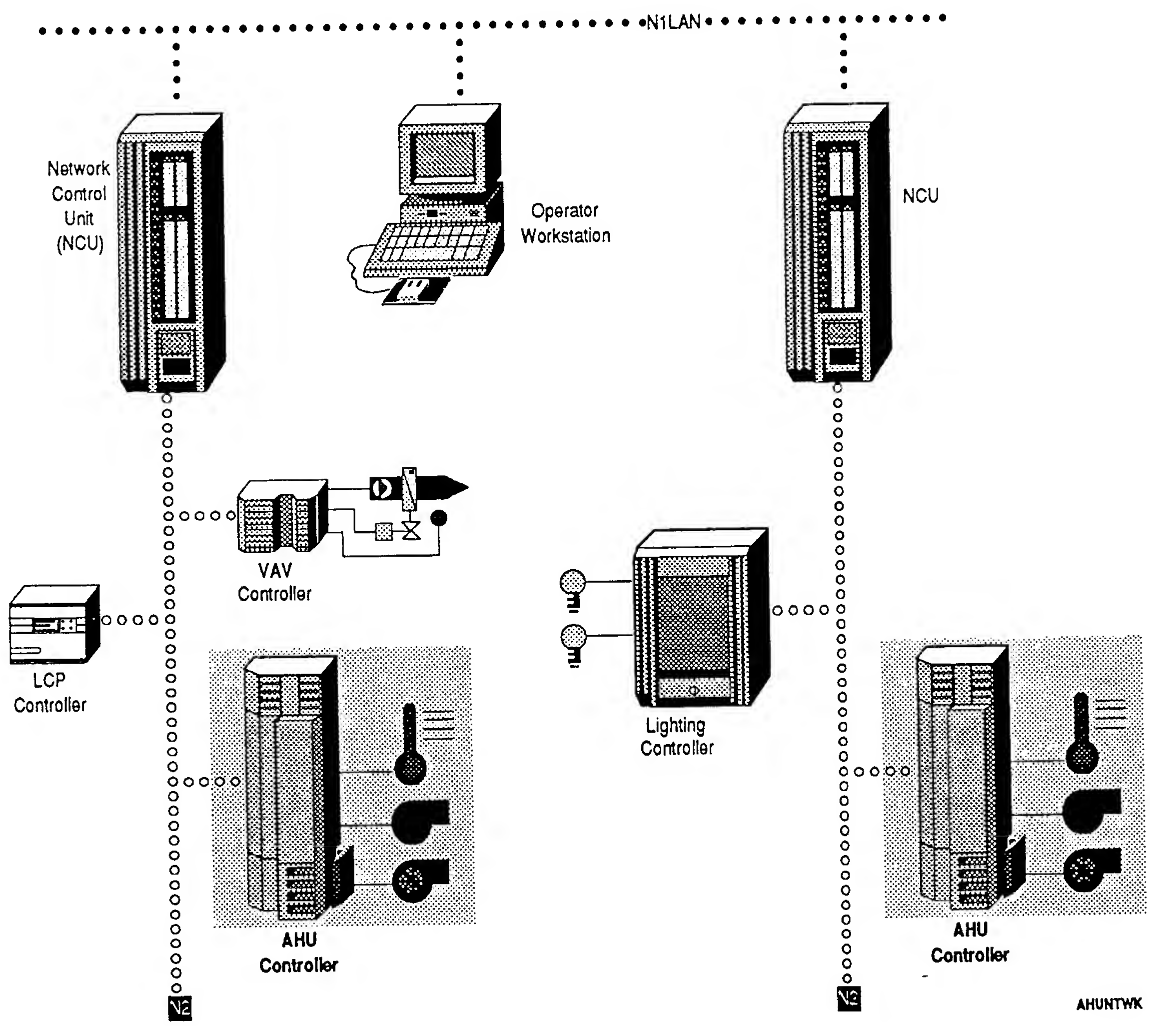

Figure 7: AHU Controller in Metasys Network

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Metasys Companion Configuration

The Metasys Companion connects to the AHU Controller over an independent N2 Bus (Figure 8). User access is through the Companion, which implements built-in energy management programs throughout the devices on the bus.

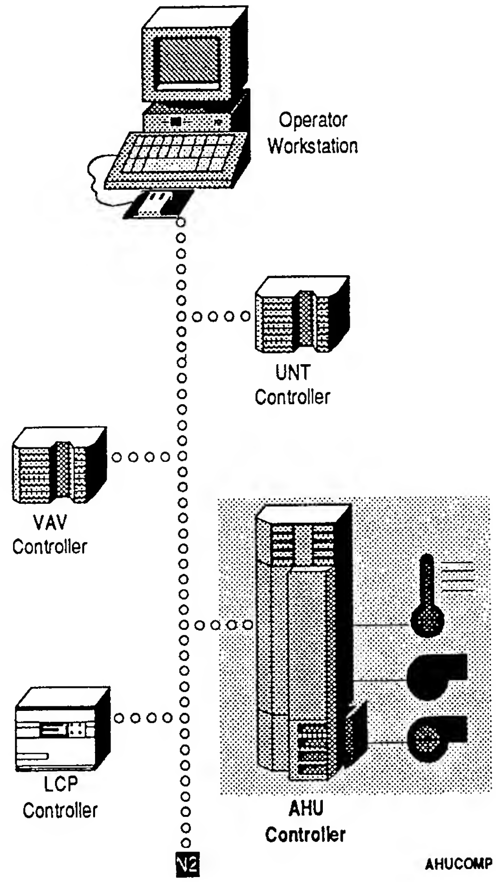

Figure 8: AHU Controller in Companion System

Sensors and Actuators to Complete the System

The AHU Controller is matched with a family of sensors, actuators, control valves, and dampers needed to complete the control of any air handler. Its sensor inputs can accept both economical passive temperature sensors as well as industry standard 4 to 20 mA or 0 to 10 VDC transmitters. Outputs are available to control both electric and pneumatic actuators, as well as motor starters and staged heating and cooling.

Application Flexibility

The AHU Controller can be configured in software to control single and dual path air handlers using either mixed air or 100% outside air. In addition, points unused in the air handler control scheme can be used in independent control loops, or in supervisory monitoring and control applications by the Metasys Network.

Table 2: Applications and Options

Application Classifications	Software Options
Primary Equipment Types	Mixed air single path Mixed air dual path 100% outside air single path 100% outside air dual path
Primary Control Strategies	Room control Room control of cooling, room reset of heating Return/exhaust air control, constant discharge setpoint Room reset of discharge setpoint Return air reset of discharge setpoint Hot/cold deck reset from coldest/warmest zone
Economizer Strategies	Dry bulb Enthalpy comparison Outside air enthalpy Differential outside/return air temperature Binary input from external economizer Vent and purge operation
Minimum Outside Air Strategies	Single damper with minimum position Separate damper—2-position Separate damper—minimum air flow station
Air Quality	Minimum position or min. flow reset by CO2 sensor
Preheat Configuration	2-position Face & bypass valve control Modulated single coil Staged electric heat Circulating pump on/off logic Preheat lockout logic

Continued on next page . . .

Application Classifications (cont.)	Software Options
Heating Configuration	2-position with face & bypass control Modulated single coil Staged electric heat Modulated common heating/cooling coil Circulating pump on/off logic Heating lockout logic
Cooling Configuration	2-position with face & bypass control Modulated single coil Staged DX Modulated common heating/cooling coil Circulating pump on/off logic Cooling lockout logic
Dehumidification	High signal select with cooling command Addition of dehumidification and cooling commands
Humidification	Modulated steam valve Staged electric heaters
Fan Start/Stop	Supply fan only Supply fan and return fan
Static Pressure Control	Single supply fan Two speed fan
Fan Volume Matching	Single supply and single return fan, differential CFM
Unused Input/Output Control Loops	Analog input to analog output Analog input to binary output Binary input to analog output Binary input to binary output
Unoccupied Control	Setup and setback Night cycle Morning warmup and cooldown

More Software Capabilities

You can assign high and low alarm limits to all analog inputs, which alerts the operator at the Metasys Operator Workstation or Companion terminal when a problem occurs, such as a temperature or static pressure exceeding a safe value.

The AHU Controller also maintains a software time-of-day clock and can store back-up on/off schedules. These schedules will keep your fan systems in the proper operating mode even if there is a communication failure with the Network Control Unit or Companion controller.

Conclusion

As either a member of the fully integrated system or as a standalone controller, the AHU Controller represents the best way to fully optimize the operation of your air handlers. It combines the best of ease of setup and operation, flexibility of application, and precise control for comfort and energy management.

Specifications

Product	AHU Controller (AS-AHU101-0 Enclosure/Terminator Kit; AS-AHU102-0, Controller Board)
Power Requirements	24 VAC, 50/60 Hz at 100 VA (from XFR100-0 Module)
Ambient Operating Conditions	32° to 122°F (0° to 50°C) 10 to 90% RH
Ambient Storage Conditions	-40° to 158°F (-40° to 70°C) 10 to 90% RH
Dimensions (H x W x D)	13.3 in. x 7.9 in. x 6.9 in. (33.8 cm x 20.0 cm x 17.4 cm)
Shipping Weight	4.13 lbs (1.87 kg)
Agency Compliance	FCC Part 15, Subpart J, Class A UL916 CSA C22.2 -205
Agency Listings	UL Listed and CSA Certified as part of the Metasys Network
Accessories (Order Separately)	
Zone Terminal	(AS-ZTU100-0)
Transformer Kit	(AS-XFR100-0)
Function Module Kit	(AS-FMK100-0)
Line Voltage Relay Kit	(AS-RLY100-0)
Generic Enclosure Kit	(AS-ENC100-0)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

METASYS

Unitary Controller

The Metasys™ Unitary (UNT) Controller is an electronic device for digital control of packaged air handling units, unit ventilators, fan coils, heat pumps, and other terminal units serving a single zone or room. It can also be configured as a generic input/output device for basic point monitoring applications when used within a Metasys Network.

You can easily configure point inputs and outputs and software features to control a wide variety of HVAC equipment applications. You may use the UNT as a standalone controller, or connected to the Metasys Network through a Network Control Module (NCM) or Companion.

When connected to the Metasys Network, the UNT provides all point and control information to the rest of the network. The devices communicate through an N2 Bus. For a smaller facility, the UNT Controller can function as a standalone controller. Figure 1 illustrates the UNT Controller.

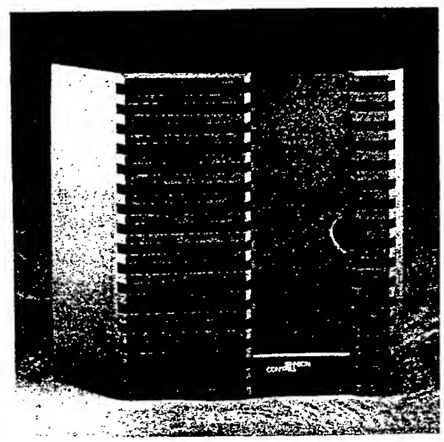

Figure 1: Unitary Controller

Features and Benefits	
❑ **Standalone Control**	System reliability
❑ **Network Communications Over N2 Bus**	Facility-wide control efficiencies and cost effective sensor sharing
❑ **Multiple Modes of Operation for Various Occupancy Conditions**	Comfort with economy
❑ **Built-in Control Program Library**	No programming
❑ **Multiple Packaging Options for Both Field and Factory Installations**	Installation flexibility
❑ **Interfaces to Both Pneumatic and Electric Actuators**	Low cost installation for both new construction and retrofit applications

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Flexible Hardware Packaging

The Unitary Controller is available in different hardware sets to suit environmental and application needs. Use Table 1 to select the type that best suits your needs.

Table 1: Unitary Controller Types

Point Type	UNT100/101	UNT110/111	UNT120/121
Ambient Temperature Rating	32°F to 140°F (0°C to 60°C)	32°F to 140°F (0°C to 60°C)	-40°F to 140°F (-40°C to 60°C)
Analog Inputs	6 RTD temperature elements (1000 ohm nickel, platinum, or silicon) 2K ohm setpoint potentiometers 0 to 10 VDC transmitters	6 RTD temperature elements (1000 ohm nickel, platinum, or silicon) 2K ohm setpoint potentiometers 0 to 10 VDC transmitters	6 RTD temperature elements (1000 ohm nickel, platinum, or silicon) 2K ohm setpoint potentiometers 0 to 10 VDC transmitters
Binary Inputs	4 (4) Dry contacts (1) Momentary push button from zone sensor for temporary occupancy mode BI4 may be used as an accumulator input for frequencies less than 100 Hz	4 (4) Dry contacts (1) Momentary push button from zone sensor for temporary occupancy mode BI4 may be used as an accumulator input for frequencies less than 2 Hz	4 (4) Dry contacts (1) Momentary push button from zone sensor for temporary occupancy mode BI4 may be used as an accumulator input for frequencies less than 2 Hz
Analog Outputs	0/2 0 to 10 VDC @ 10 mA	0/2 0 to 10 VDC @ 10 mA	0/2 0 to 10 VDC @ 10 mA
Binary Outputs	8/6 24 VAC Triacs @ ».5 amps	8/6 24 VAC Triacs @ ».5 amps Low or High side common selectable	8/6 24 VAC Triacs @ ».5 amps Low or High side common selectable
N2 Bus	Not Isolated	Isolated	Isolated
Zone Bus	Spade connectors at controller 8-pin phone jack on controller 6-pin phone jack at zone sensor	Spade connectors at controller 8-pin phone jack on controller 6-pin phone jack at zone sensor	Spade connectors at controller 8-pin phone jack on controller 6-pin phone jack at zone sensor

Controller Enclosure

The controller mounts easily to any surface using either direct mount or a controller enclosure. The common packaging for the UNT100/101 and UNT110/111 is in the AS-ENC100-0, or in an enclosure provided by the contractor.

The UNT120/121 Controller must be installed in the BZ-1000-7 Enclosure unless it is mounted within the enclosed low voltage electrical compartment of the mechanical unit being controlled.

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Easy Monitoring and Diagnostics With the Zone Terminal

The Zone Terminal AS-ZTU100-0 (ZT) is a person / controller interface developed as an easy-to-use controller adjustment and indication device. The ZT is designed for the user who needs a straightforward method to monitor and adjust points in an HVAC zone. The ZT plugs into the Zone Sensor to communicate with a UNT Controller when used as a commissioning tool. The ZT can also be permanently connected to provide alarm indication and scheduling for a Unitary Controller.

Convenient Configuration Setup

The UNT Controller does not need to be programmed in the traditional sense. Instead, the control algorithms and input/output point assignments are configured with the use of the HVAC PRO software tool.

The HVAC PRO runs on a laptop computer plugged directly into the UNT Controller or into a jack at the room sensor. The jack is connected back to the UNT Controller over a simple twisted pair cable called a Zone Bus. Programs loaded into the UNT Controller are saved in nonvolatile E^2PROM memory, so there is no need to reload software after a loss of power.

Programming a UNT Controller is a simple matter of responding to a series of "yes / no" and multiple choice questions, and specifying setpoints and other parameters. No previous software programming experience is required.

The UNT Controller has a library of proven control sequences and proportional-integral algorithms that are automatically configured into a total system sequence-of-operation in response to your answers to the questions. Once configured, the UNT Controller's operating parameters, such as setpoints, gains, alarm limits, and so forth, may be changed from any Metasys operator device.

Metasys Network Configuration

As powerful as the UNT Controller is by itself, your facility benefits even more when UNT Controllers are part of a larger Metasys Network. Each UNT Controller can connect to the Metasys N2 Bus (Figure 2). Either a Network Control Unit or Companion System can be programmed to provide added energy management and supervisory control capabilities, including optimal start, demand limiting, load rolling, run time totalization, and more.

The Metasys Dynamic Data Access™ networking software, available from the Network Control Unit, makes all information from each UNT Controller available throughout the facility, so that it is possible, for example, to reset chiller or boiler temperatures based on the load demands of the UNT Controllers. Dynamic Data Access also makes sensor values, operating status, and any other parameter in the UNT Controller available to operators anywhere in your facility.

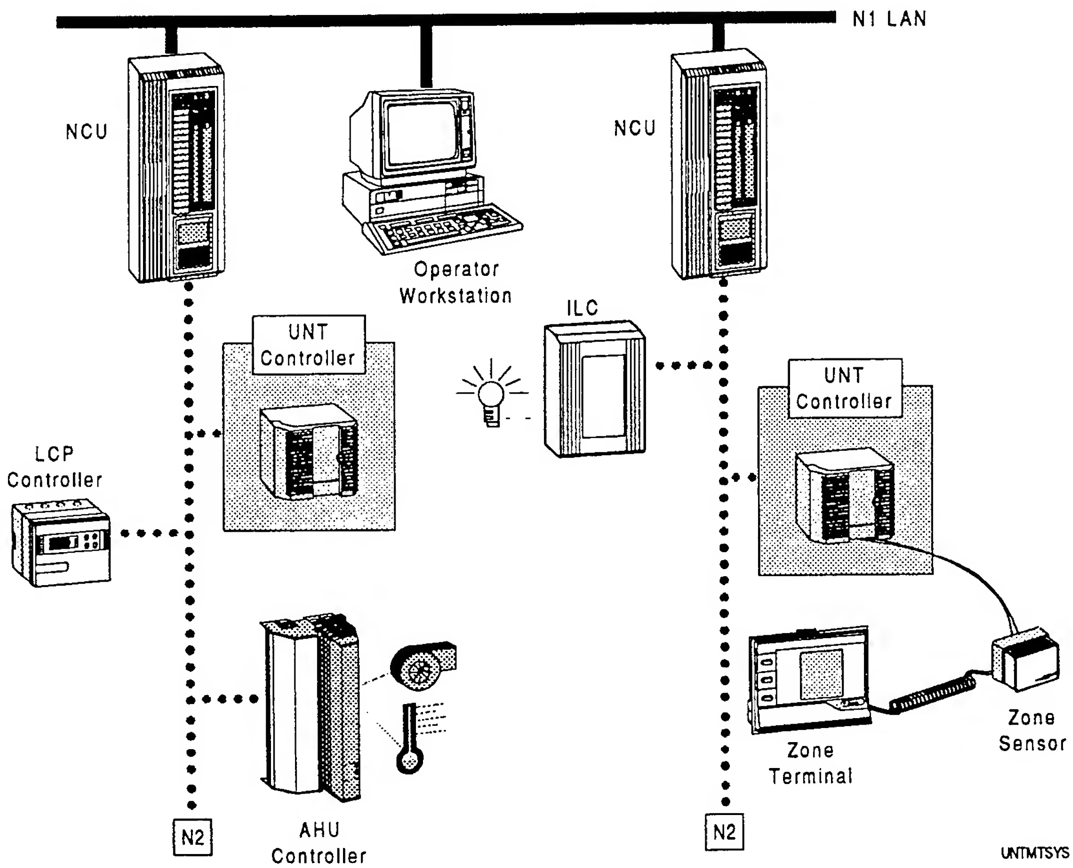

Figure 2: UNT Controller in Metasys Network

Metasys Companion Configuration

The Metasys Companion connects to the UNT Controller over an independent N2 Bus (Figure 3). User access is through the Companion, which implements built-in energy management programs throughout the devices on the bus.

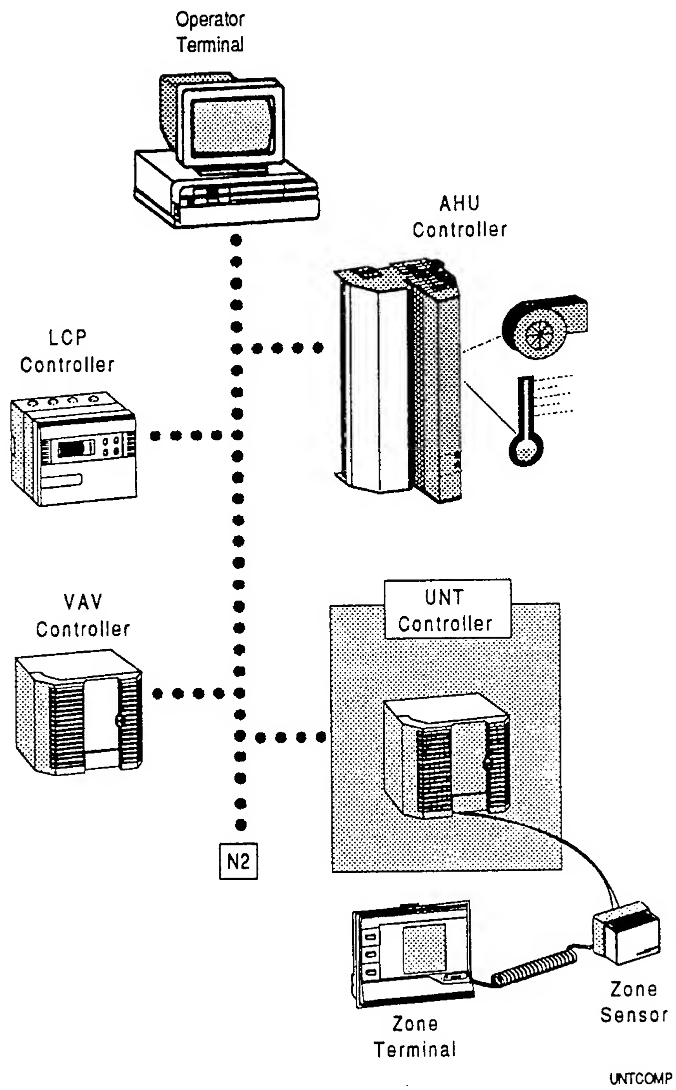

Figure 3: UNT Controller in Companion System

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Application Flexibility

The UNT Controller can be configured in software to control a wide variety of packaged equipment. In addition, points unused in the control scheme can be used in supervisory monitoring applications by the Metasys Network.

The UNT Controller offers a variety of zone sensor connection options that let you select the features you—and your occupants—need. The simplest and most economical option is a solid-state sensing element wired directly to the controller. When this option is chosen, all setpoint adjustments and programming changes are made using the Operator Workstation or Network Terminal on the Metasys Network, or from the Operator Terminal on a Companion system.

An option provides the occupants in the zone the ability to adjust the setpoint to their preference, within a restricted range established by you.

The user setpoint can be overridden by you at any time using the operator interface devices or application programs in the Network Control Unit. This allows maximum energy savings, while still allowing occupants some control over their environment.

A second option uses a temporary override switch within the zone sensor package to automatically change to occupied conditions. This can further increase energy savings in individual offices or conference rooms.

Other options provide control of room lighting, as well as temperature, turning lights on or off based on the occupancy sensor, or scheduled commands issued from the network. A "boost" mode switch allows an occupant to temporarily provide extra cooling or heating. This is useful for conference rooms experiencing large heat load fluctuations.

Table 2: Applications and Options

Application Classifications	Software Options	
Primary Equipment Types	Unit vents	ASHRAE Cycle 1 ASHRAE Cycle 2 ASHRAE Cycle 3 ASHRAE Cycle W
	Heat pumps	Water to Air Air to Air
	Packaged rooftops	
	Fan coils	
Primary Control Strategies	Room/zone control	
Economizer Changeover Strategies	Dry bulb Outside air enthalpy Differential outside/return air temperature Binary input from external economizer Supervisory network command	
Mixed Air Control Strategies	Proportional output to OA/RA damper actuator Binary output to economizer actuator	
Heating Configuration	Modulated single coil Staged electric heat (2-stage max.) Modulated common heating/cooling coil Reversing valve logic	
Continued on next page . . .		

Application Classifications (Cont.)	Software Options
Cooling Configuration	Modulated single coil Staged DX (2-stage max) Modulated common heating/cooling coil Reversing valve logic
Fan Start/Stop	Continuous Operation Cycled with call for heating/cooling
Lighting Control	On and off outputs to lighting relay in conjunction with Occ/Unocc mode.
Unoccupied Control	Setup and setback Morning warmup and cooldown

More Software Capabilities

The UNT Controller has additional capabilities to help manage your facility. You can assign high and low alarm limits to all analog inputs, to alert an operator at the Metasys Operator Workstation or Companion terminal when a problem occurs, such as a zone or mixed air temperature exceeding comfort or safety values.

The UNT Controller also maintains a software time-of-day clock and can store backup on/off schedules. These schedules will keep your fan systems in the proper operating mode even if there is a communication failure with the Network Control Unit or Companion controller.

Conclusion

As either a member of the fully integrated system, or as a standalone controller, the UNT Controller represents the best way to fully optimize the operation of your HVAC equipment. It combines the best of ease of setup and operation, flexibility of application, and precise control for comfort and energy management.

Specifications

Product	AS-UNT100-0 / AS-UNT101-0 AS-UNT110-0 / AS-UNT111-0
Ambient Operating Conditions	32° to 140°F (0° to 60°C) 10 to 90% RH
Dimensions (H x W x D)	6.5 in. x 6.4 in. x 2.0 in. (165 x 163 x 51 mm) without enclosure 6.8 in. x 7.3 in. x 4.7 in. (173 x 185 x 119 mm) with the AS-ENC100-0 Enclosure
Product	AS-UNT120-0 / AS-UNT121-0
Ambient Operating Conditions	-40° to 140°F (-40° to 60°C) 10 to 90% RH
Dimensions (H x W x D)	6.5 in. x 6.4 in. x 2.0 in. (165 mm x 163 mm x 51 mm) without enclosure 10.2 in. x 9.8 in. x 3 in. (259 mm x 248 mm x 76 mm) with the BZ-1000-7 Enclosure
Ambient Storage Conditions	-40° to 158°F (-40° to 70°C) 10 to 90% RH
Power Requirements	24 VAC, 50/60 Hz
Shipping Weight	1.4 lbs (0.64 kg)
Agency Compliance	CSA C22.2 No. 205 FCC Part 15, Subpart J, Class A IEEE 446 IEEE 472 IEEE 518 IEEE 587 Category A UL 916 NEMA ICS 2, Part 2-230 VDE 0871 Class B
Agency Listings	UL Listed and CSA Certified as part of the Metasys Network
Accessories (Order Separately)	
Zone Terminal	(AS-ZTU100-0)
Enclosure Kit	(AS-ENC100-0) for UNT110/111 (BZ-1000-7) for UNT120/121

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

JOHNSON CONTROLS

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FAN 635
Metasys Network Sales Resource Manual
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-METASYS-

Variable Air Volume Controller

The Variable Air Volume (VAV) Controller is an electronic device for digital control of single duct, dual duct, fan powered, and supply/exhaust VAV box configurations. Along with the capability of standalone control of the VAV box, the controller can also integrate the control of the room or zone baseboard heat and lighting logic. You may use the VAV as a standalone controller, or connected to the Metasys™ Network through a Network Control Module (NCM) or Companion.

When connected to the Metasys Network, the VAV provides all point and control information to the rest of the network. The devices communicate through an N2 Bus. The VAV Controller can also function as a standalone controller. Figure 1 illustrates the VAV Controller.

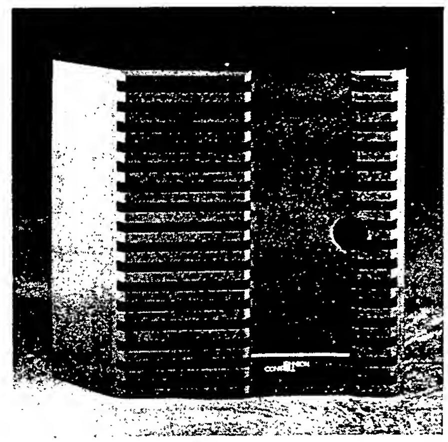

Figure 1: Variable Air Volume Controller

Features and Benefits	
❑ **Standalone control**	System reliability
❑ **Network communications over N2 Bus**	Facility-wide control efficiencies and cost effective sensor sharing
❑ **Multiple modes of operation for various occupancy conditions**	Comfort with economy
❑ **Built-in control program library**	No programming
❑ **Multiple packaging options for both field and factory installations**	Installation flexibility

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Flexible Hardware Packaging

The Variable Air Volume Controller can be configured to match most applications found in todays fast evolving VAV marketplace. The VAV is available in two different models which vary only by their output point configuration, allowing you to economically select a controller to match the VAV box application. In addition, cable kits are available to make connection between the controller and the damper actuator and velocity pressure transducer easy.

Table 1: Variable Air Volume Controller Types

POINT TYPE	VAV100	VAV101
Ambient Temperature Rating	32°F to 140°F (0°C to 60°C)	32°F to 140°F (0°C to 60°C)
Analog Inputs	6 RTD temperature elements (1000 ohm nickel, platinum, or silicon) 2 K ohm setpoint potentiometers 0 to 10 VDC transmitters	6 RTD temperature elements (1000 ohm nickel, platinum, or silicon) 2 K ohm setpoint potentiometers 0 to 10 VDC transmitters
Binary Inputs	4 (4) Dry contacts (1) Momentary push button from zone sensor for temporary occupancy mode	4 (4) Dry contacts (1) Momentary push button from zone sensor for temporary occupancy mode
Analog Outputs	0	2 0 to 10 VDC @ 10 mA
Binary Outputs	8 24 VAC Triacs @ •.5 amps	6 24 VAC Triacs @ •.5 amps
Zone Bus	spade connectors at controller 8 pin phone jack on controller 6 pin phone jack at zone sensor	spade connectors at controller 8 pin phone jack on controller 6 pin phone jack at zone sensor

Controller Enclosure

The controller mounts easily to any surface using either direct mount or a controller enclosure. The common packaging for the VAV Controller is in the AS-ENC100-0, or in an enclosure provided by the VAV box manufacturer.

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Easy Monitoring and Diagnostics with the Zone Terminal (AS-ZTU100-0)

The Zone Terminal (ZT) is a person/controller interface developed as an easy-to-use controller adjustment and indication device. The ZT is designed for the user who needs a straightforward method to monitor and adjust points in an HVAC zone. The ZT plugs into the TE-6410 Metastat™ to communicate with or perform balancing of a VAV box system.

Convenient Configuration Setup

The VAV Controller doesn't need to be programmed in the traditional sense. Instead, the control algorithms and input/output point assignments are configured with the use of the HVAC PRO software tool.

The HVAC PRO runs on a laptop computer plugged directly into the VAV Controller or into a jack at the room sensor. The jack is connected back to the VAV Controller over a simple twisted pair cable called a Zone Bus. Programs loaded into the VAV Controller are saved in nonvolatile E^2PROM memory, so there is no need to reload software after a loss of power.

A second option allows you to load the configuration from the laptop via the N2 Bus. This option speeds up the initial loading and commissioning process prior to performing the final balancing procedures.

Programming a VAV Controller is a simple matter of responding to a series of "yes-no" and multiple choice questions, and specifying setpoints and other parameters. No previous software programming experience is required.

The VAV Controller has a library of proven control sequences and proportional-integral algorithms that are automatically configured into a total system sequence-of-operation in response to your answers to the questions.

Once configured, the VAV Controller's operating parameters, such as setpoints, gains, alarm limits, and so forth, may be changed from any Metasys operator device.

Factory Mounting Relationships

The original equipment manufacturers set up the VAV control system for factory mounting. This benefits you by lowering the overall cost of the installation.

Metasys Network Configuration

As powerful as the VAV Controller is by itself, your facility will benefit even more when VAV Controllers are part of a larger Metasys Network. Each VAV Controller can connect to the Metasys N2 Bus (Figure 2). Either a Network Control Unit or Companion system can be programmed to provide added energy management and supervisory control capabilities, including optimal start, demand limiting, load rolling, run time totalization, and more.

The Metasys Dynamic Data Access™ networking software, available from the Network Control Unit, makes all information from each VAV Controller available throughout the facility, so that it is possible, for example, to reset chiller or boiler temperatures based on the load demands of the VAV Controllers. Dynamic Data Access also makes sensor values, operating status, and any other parameter in the VAV Controller available to operators anywhere in your facility.

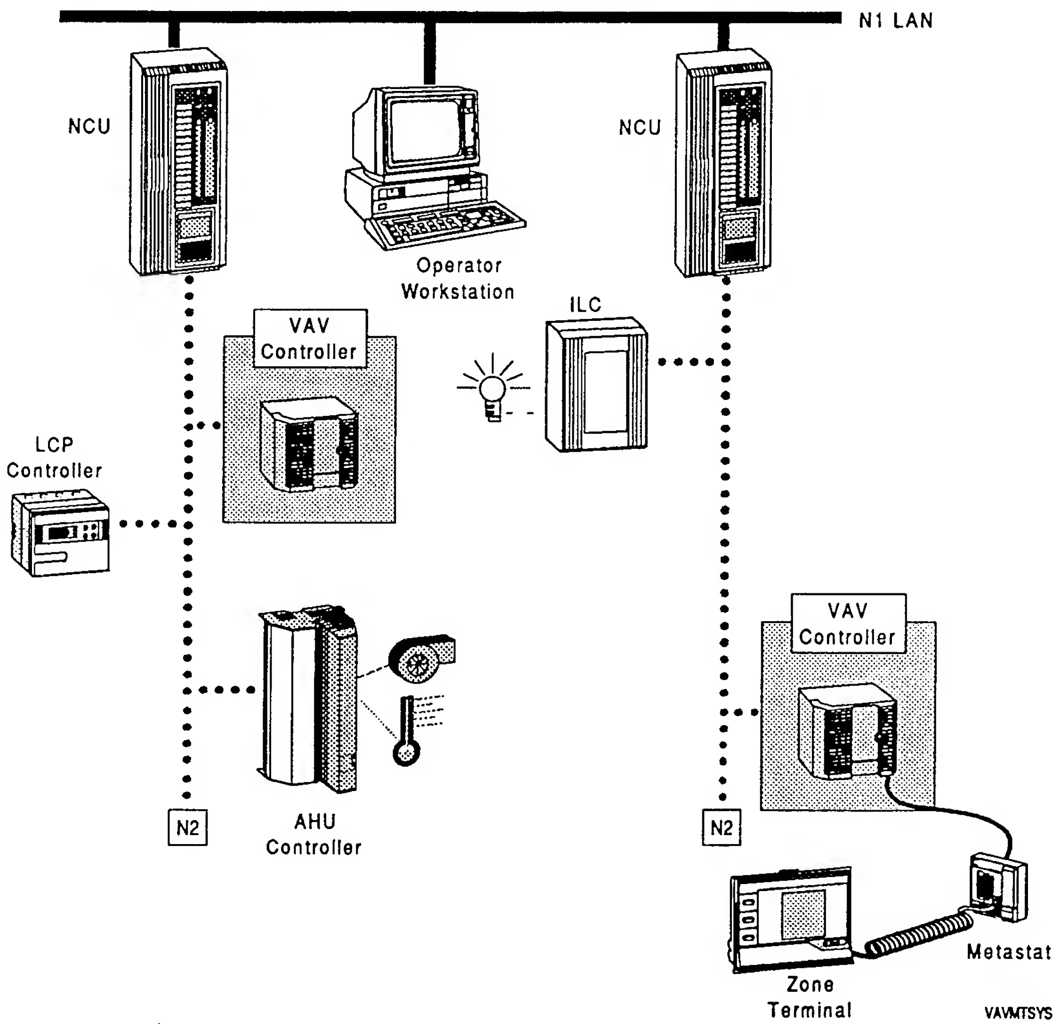

Figure 2: VAV Controller in Metasys Network

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Metasys Companion Configuration

The Metasys Companion connects to the VAV Controller over an independent N2 Bus (Figure 3). User access is through the Companion, which implements built-in energy management programs throughout the devices on the bus.

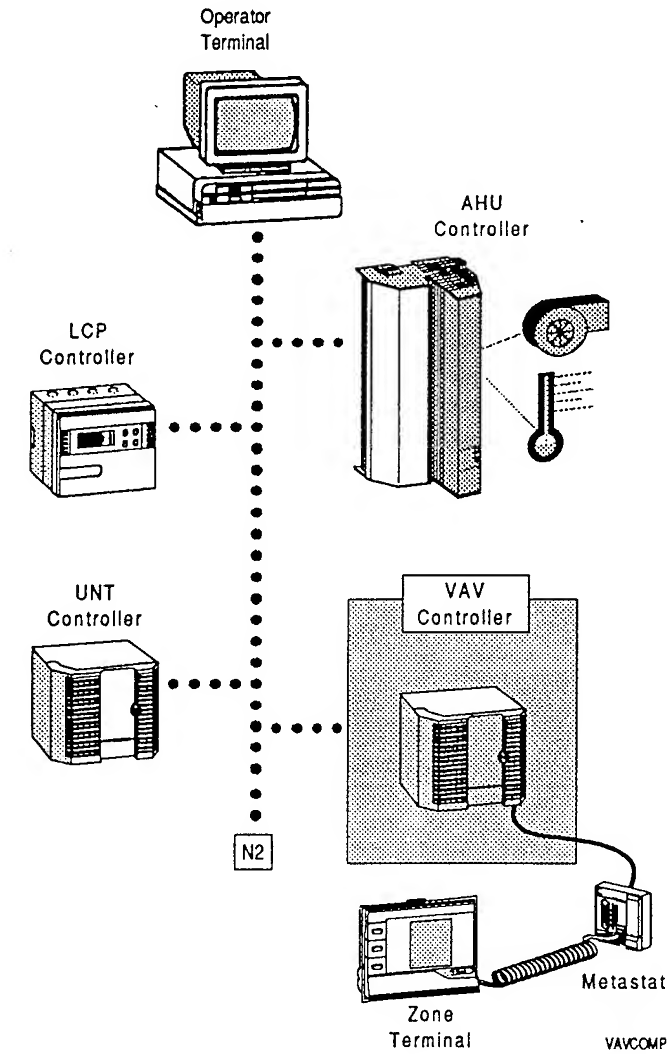

Figure 3: VAV Controller in Companion System

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Application Flexibility

The VAV Controller can be configured to match most applications found in today's rapidly evolving VAV marketplace. The VAV-10n series is packaged for factory mounting by original equipment manufacturers in their panels. The ENC100 enclosure is used when an enclosure is not provided by the original equipment manufacturer. In addition, points unused in the control scheme can be used in supervisory monitoring and control applications by the Metasys Network.

The VAV Controller offers a variety of zone sensor connection options that let you select the features you – and your occupants – need. The simplest and most economical option is a solid-state sensing element wired directly to the controller. When this option is chosen, all setpoint adjustments and programming changes are made using the Operator Workstation or Network Terminal on the Metasys Network, or from the Operator Terminal on a Companion system.

An option provides the occupants in the zone the ability to adjust the setpoint to their preference, within a restricted range established by you. The user setpoint can be overridden by you at any time using the operator interface devices or application programs in the Network Control Unit. This allows maximum energy savings while still allowing occupants some control over their environment.

A second option uses an occupancy sensor to automatically or manually setback or setup zone temperatures when no one is around. This can further increase energy savings in individual offices or conference rooms.

Other options provide for control of room lighting as well as temperature, turning lights on or off based on the occupancy sensor or scheduled commands issued from the network. A "Boost" mode switch allows an occupant to temporarily provide extra cooling or heating, which is useful for conference rooms that experience large heat load fluctuations.

Table 2: Applications and Options

Application Classifications	Software Options	
Primary Equipment Types	VAV Box	Single Duct Dual Duct Fan Powered or Assisted Supply/Exhaust
Primary Control Strategies	Pressure Dependent Pressure Independent Constant Volume Auto Zero of Flow Transducers	
Box Heat Configuration	Incremental Time Based Proportional (3 Stages Maximum)	
Baseboard Heat Configuration	Incremental Time Based Proportional (1 Stage)	
Cooling Configuration	Incremental Output to Damper Actuator	
Fan Configurations	Parallel, Temperature Setpoint Parallel, CFM Setpoint Series, On-Off Control Series, Proportional Control	
Lighting Control	On and off outputs to lighting relay in conjunction with Occ/Unocc mode	
Occupied Selections	Occupied/Unoccupied, Standby, Shutdown, Boost Control, Morning Warm-Up, and Cooldown	

More Software Capabilities

The VAV Controller has additional capabilities to help manage your facility. For example, the velocity sensor input to a pressure independent system can be automatically calibrated to its zero flow point once per day to ensure the VAV Controller maintains accuracy at low flows. You can also set up this feature to be implemented on a time schedule through the N2 network so that a critically controlled zone's airflow is not interrupted during occupied conditions.

You can assign high and low alarm limits to all analog inputs to alert an operator at the Metasys Operator Workstation or Companion terminal when a problem occurs, such as a zone or mixed air temperature exceeding comfort or safety values.

The VAV Controller also maintains a software time-of-day clock and can store backup on/off schedules. These schedules will keep your local zones in the proper operating mode even if there is a communication failure with the Network Control Unit or Companion controller.

Conclusion

As either a member of the fully integrated system, or as a standalone controller, the VAV Controller represents the best way to optimize the operation of your HVAC equipment. The VAV Controller combines the best of ease-of-setup and operation, flexibility of application, and precise control for comfort and energy management.

Specifications

Product	AS-VAV100-0 / AS-VAV101-0
Ambient Operating Conditions	32° to 140°F (0° to 60°C) 10 to 90% RH
Dimensions (H x W x D)	6.5 in. x 6.4 in. x 2.0 in. (165 x 163 x 51 mm) without enclosure 6.8 in. x 7.3 in. x 4.7 in. (173 x 185 x 119 mm) with the AS-ENC100-0 enclosure
Ambient Storage Conditions	-40° to 158°F (-40° to 70°C) 10 to 90% RH
Power Requirements	24 VAC, 50/60 Hz at 40 VA (per typical system)
Shipping Weight	1.4 lbs (0.64 kg)
Agency Compliance	CSA C22.2 No. 205; FCC Part 15, Subpart J, Class A; IEEE 446 IEEE 472; IEEE 518; IEEE 587 Category A UL 916; NEMA ICS 2, Part 2-230; VDE 0871 Class B
Agency Listings	UL Listed and CSA Certified as part of the Metasys Network
Accessories (Order Separately)	
Zone Terminal	(AS-ZTU100-0)
Enclosure Kit	(AS-ENC100-0)
Zone Sensors	(TE-6410 Series)
Damper Actuator/Velocity Sensor Package	(ATP-2040 Series)
Controller/Velocity Sensor Package	(AS-VAVDPT Series)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

JOHNSON CONTROLS

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FAN 635
Metasys Network Sales Resource Manual
Printed in U.S.A.

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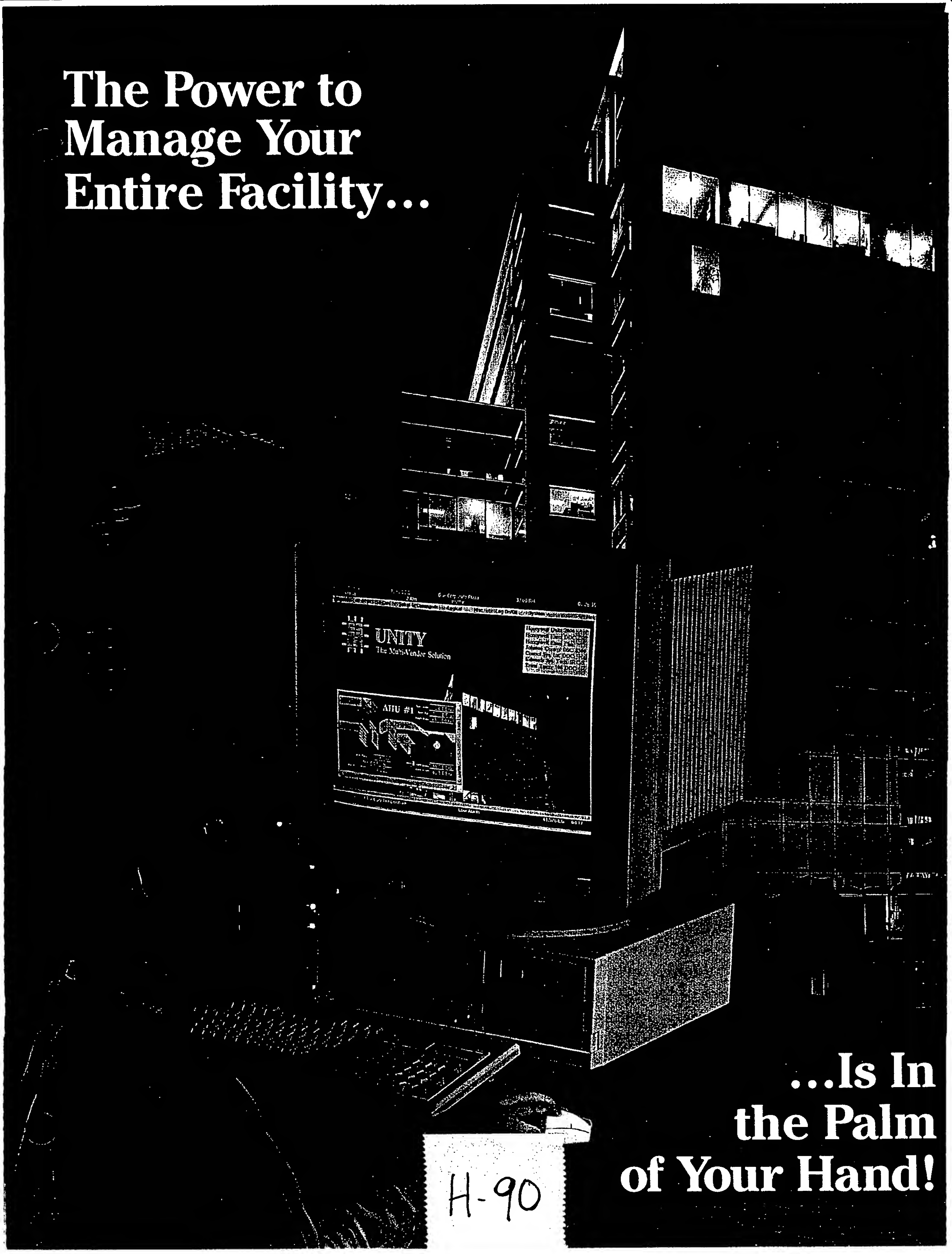

The Power to Manage Your Entire Facility...
UNITY
The Multi-Vendor Solution
AHU #1
...Is In the Palm of Your Hand!

H-90

Integrate Dissimi

UNITY from Electronic Systems USA
The Multi-Vendor Leader

If you're locked into a single supplier for your facility's automation systems, or struggling with a variety of equipment that won't communicate, *you are not alone!*

If you're coping with restricted access to parts, information and support, or being totally eliminated from the competitive bid process, *there is a solution!*

If you're still waiting for an answer like BACnet, *you don't have to wait any longer!*

The Future of Building Automation—*Today!*

As the nation's leading multi-vendor supplier of products and services to the building automation industry, Electronic Systems USA will put *you* in complete control of your facility—with a revolutionary product called UNITY.

UNITY is a powerful CPU replacement designed to fully integrate your entire facility—HVAC, Fire/Life Safety, Security and more—into a single, PC based system. UNITY offers you the flexibility and ease of operation to maximize your resources in today's tough economy!

A New Kind of Freedom

UNITY is the only true multi-vendor platform available to Honeywell and Johnson Controls system owners.

UNITY features an exclusive Open Communication Platform. Cumbersome programming languages are virtually eliminated, and major manufacturers' HVAC, Fire/Life Safety and Security equipment are seamlessly integrated into a single operating system.

UNITY also allows full integration of the latest advanced Direct Digital Control (DDC) and addressable fire alarm products.

Leading Edge Technology

UNITY features a Graphic User Interface for easy access and control with minimal computer experience. UNITY runs under IBM's OS/2 multi-tasking operating software, making it the only reliable alternative in mission-critical applications.

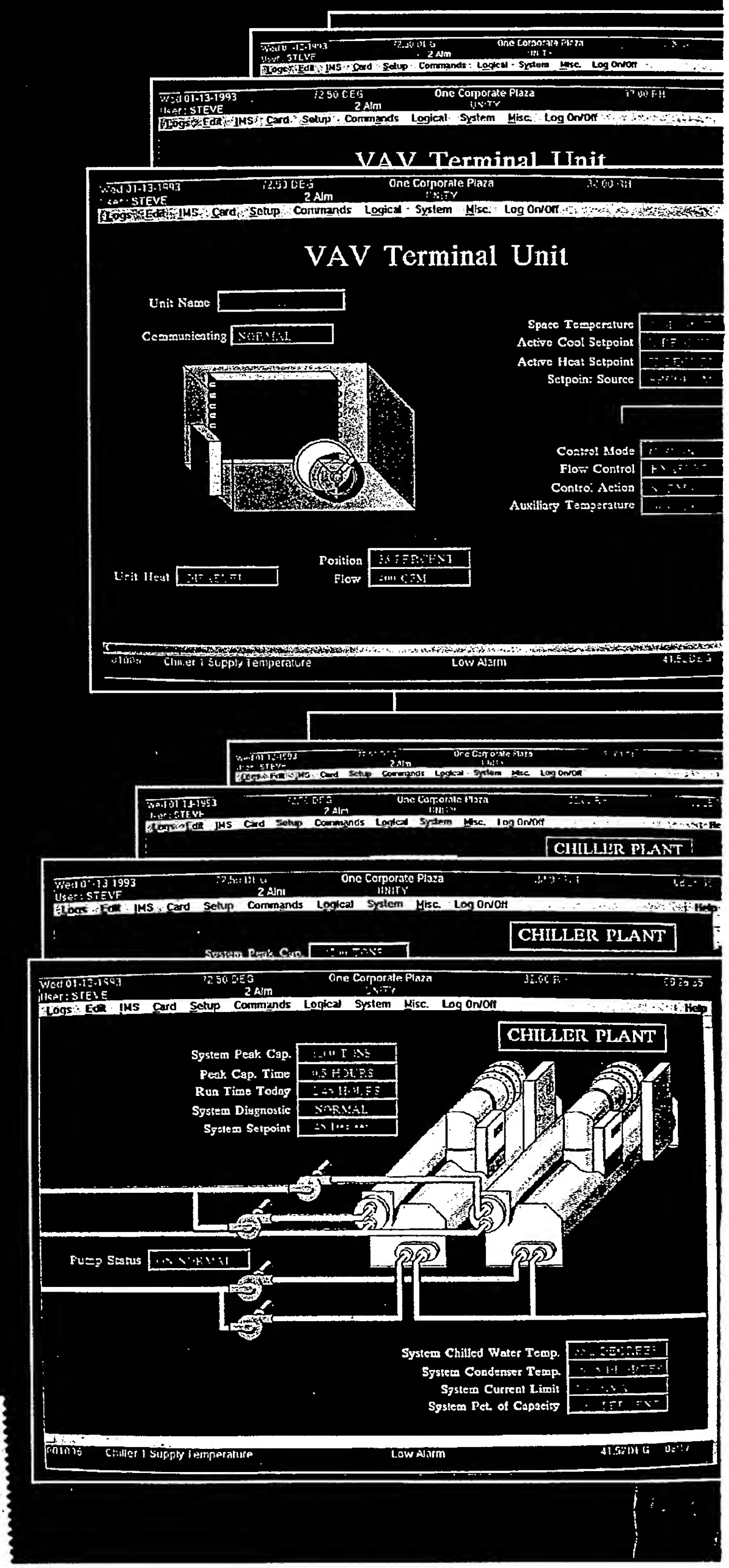
UNITY is UL Listed for fire and security applications and operates on standard, off-the-shelf PC equipment. UNITY supports Arcnet, Ethernet, Token Ring and other LAN configurations.

From the World's Tallest Office Building to Maximum Security Facilities

UNITY is currently operating in some of the most prestigious facilities in the United States and abroad, replacing front-end equipment in highly complex and sophisticated Honeywell and Johnson Controls automation systems.

UNITY *is* Total Facility Management

Through UNITY, you have the power to integrate dissimilar systems and choose the original equipment manufacturers that best meet your facility's needs. The technology is available *today* from Electronic Systems USA!



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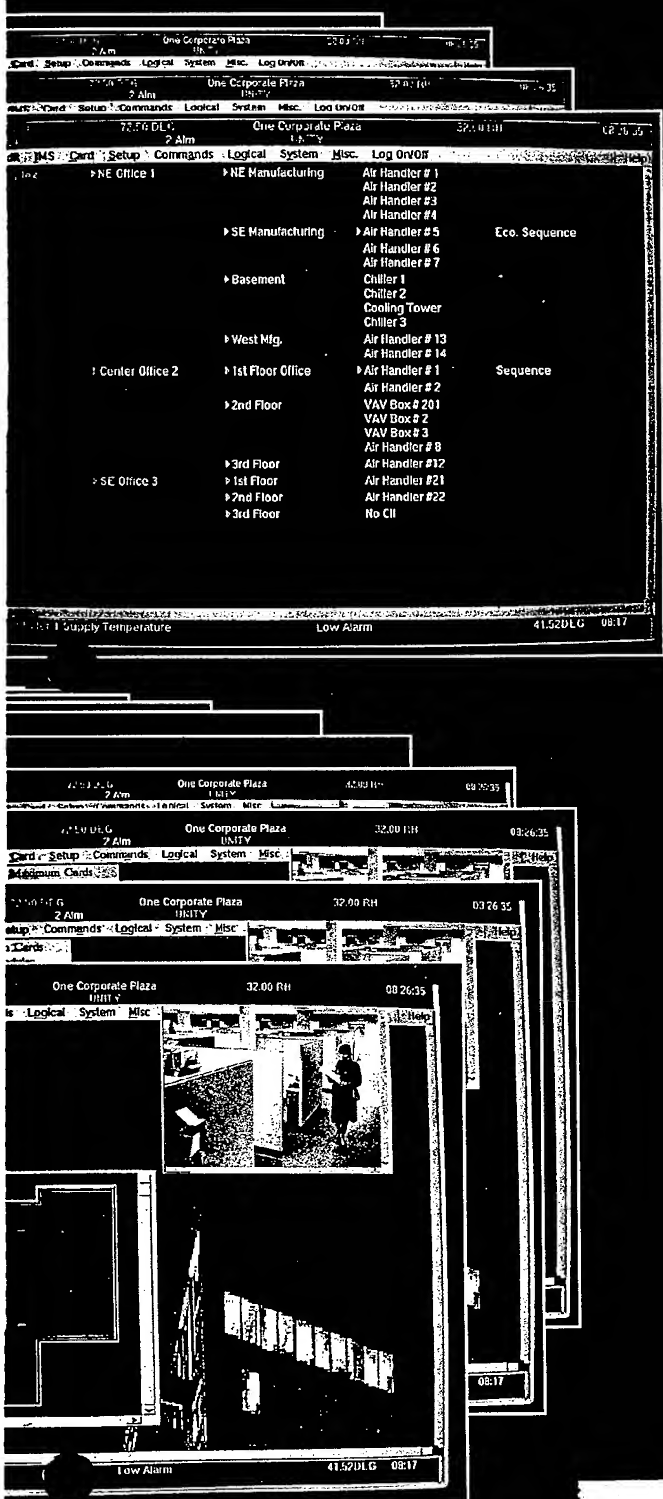
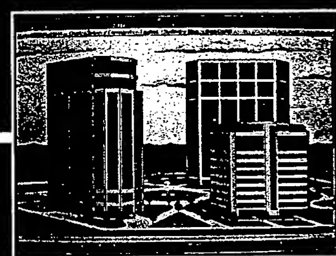
H-92

edom of Choice!

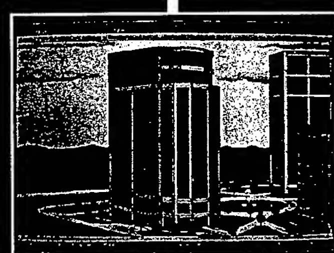


The Logical Group Tree™

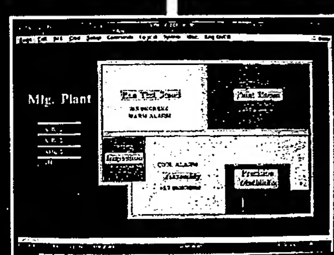
UNITY features another quantum leap in facility management technology—The Logical Group Tree™. Designed and developed exclusively by Electronic Systems USA, The Logical Group Tree™ maps all building control operations—in extraordinary detail. This unique approach provides a simple, logical way to organize, monitor and control your combined building management systems. By dividing your entire facility into functional groups in logical progression, you can operate at peak efficiency.



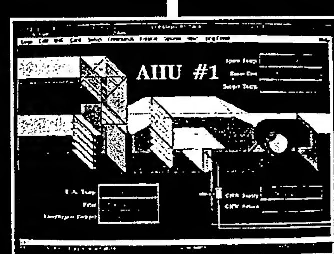
1. The Logical Group Tree™ is instantly accessed by a click of a mouse. A typical "tree" consists of buildings within a complex, floors within the buildings, and progresses to individual system components such as chillers, air handling units, security doors, fire devices, etc.



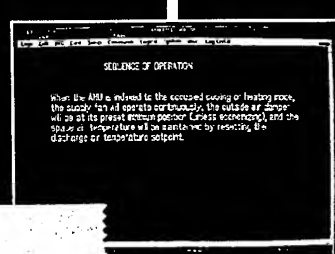
2. Simply point to the building you wish to access, click on it, and a structural drawing automatically appears.



3. Your next click selects the desired floor plan. At any time, you can move directly to any of the tree's branches—or continue viewing the selected floor. UNITY allows both graphical penetration and random selection of graphics. This saves valuable time in emergency situations.



4. Continued graphical penetration quickly selects the desired piece of equipment or field point, and live data is displayed.



5. One final click of the mouse displays a sequence of operation in text form. Instant information is now available to you, as well as field technicians and building managers.

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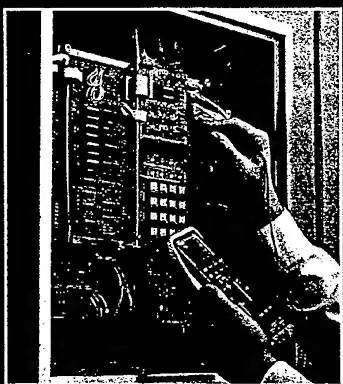
Custom Design and Engineering

Every UNITY system is designed to be site-specific. Upon completion of a detailed site inspection, a hand-picked team of applications engineers will customize every system to meet and exceed detailed facility requirements. Each UNITY system is engineered complete with customized graphics and specialized applications. Electronic Systems USA is committed to complete customer satisfaction. We are a national company with national resources, a dedicated sales staff, and a strong technical infrastructure to support our growing network of branches and service centers.



Turn-Key Installation

Installing UNITY is a simple and smooth operation. All database conversion takes place prior to installation, keeping system downtime to an absolute minimum. Electronic Systems USA performs built-in system training on site to ensure complete operator comfort with every UNITY installed.

Comprehensive Training

We have been supporting system owners with some of the finest training in the industry since 1979. Our qualified instructors offer a customized, "hands-on" approach to the programming and applications of every UNITY system. Instruction is available on-site, or at Electronic Systems USA's Corporate Training Center in Louisville, Kentucky.

Electronic Systems USA works on a continuing basis with Underwriters Laboratories Inc.® to ensure that our products and services meet all applicable UL standards. UNITY is fully UL Listed for fire and security applications. Electronic Systems USA also holds a national listing under the Burglary and Fire Alarm Service Certification Program. This authorizes us to perform inspections of existing systems and issue UL Certificates of Compliance for applicable NFPA 72 series standards.

Quality Parts

Electronic Systems USA maintains an extensive inventory of the finest quality new and reconditioned parts to maintain your HVAC, Fire/Life Safety and Security systems. Our extensive inventory offers you a valuable source for parts that may no longer be available from the original manufacturer. Our exclusive two-year warranty on all reconditioned parts proves that we stand behind what we sell! Call toll free 1-800-765-7773 for pricing and delivery.

Superior Products Backed by a Proven Company

Our accomplishments in multi-vendor applications have placed UNITY in some of the most prestigious buildings in the world. We offer superior automation products that will help you maintain your building's systems today, and well into the future. Every UNITY system installed receives specific off-site system diagnosis and software support from a veteran team of dedicated product support engineers.

The Nation's Leader in Multi-Vendor Systems Integration

Put the nation's leading supplier of multi-vendor products and services to work for you.
Electronic Systems USA—integrating dissimilar systems, and restoring your freedom of choice!

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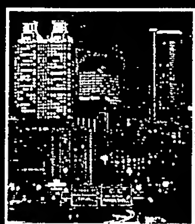

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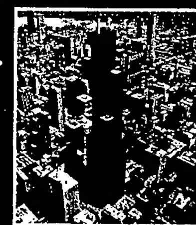

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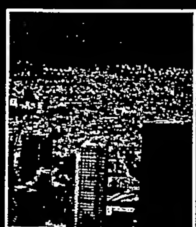

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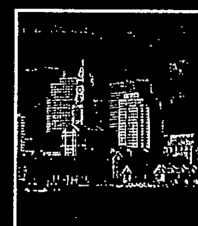

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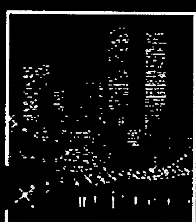

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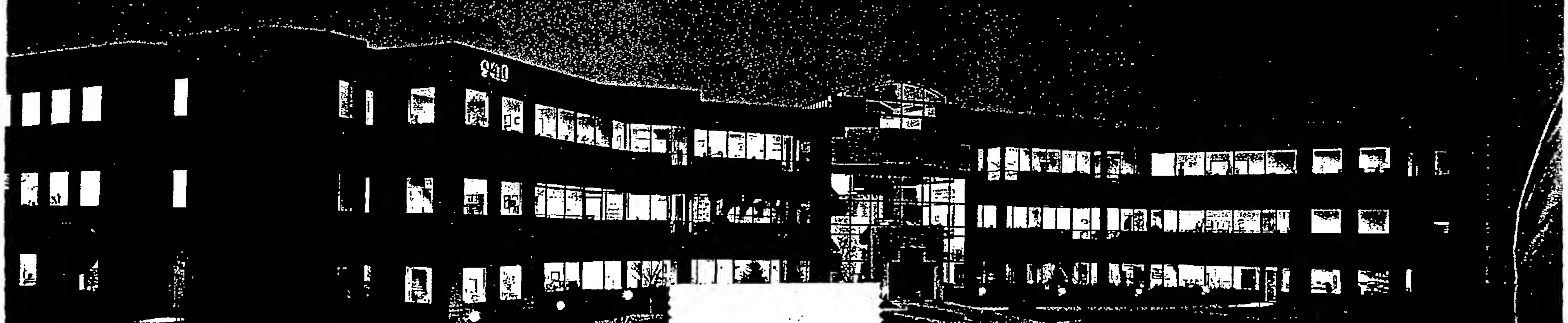

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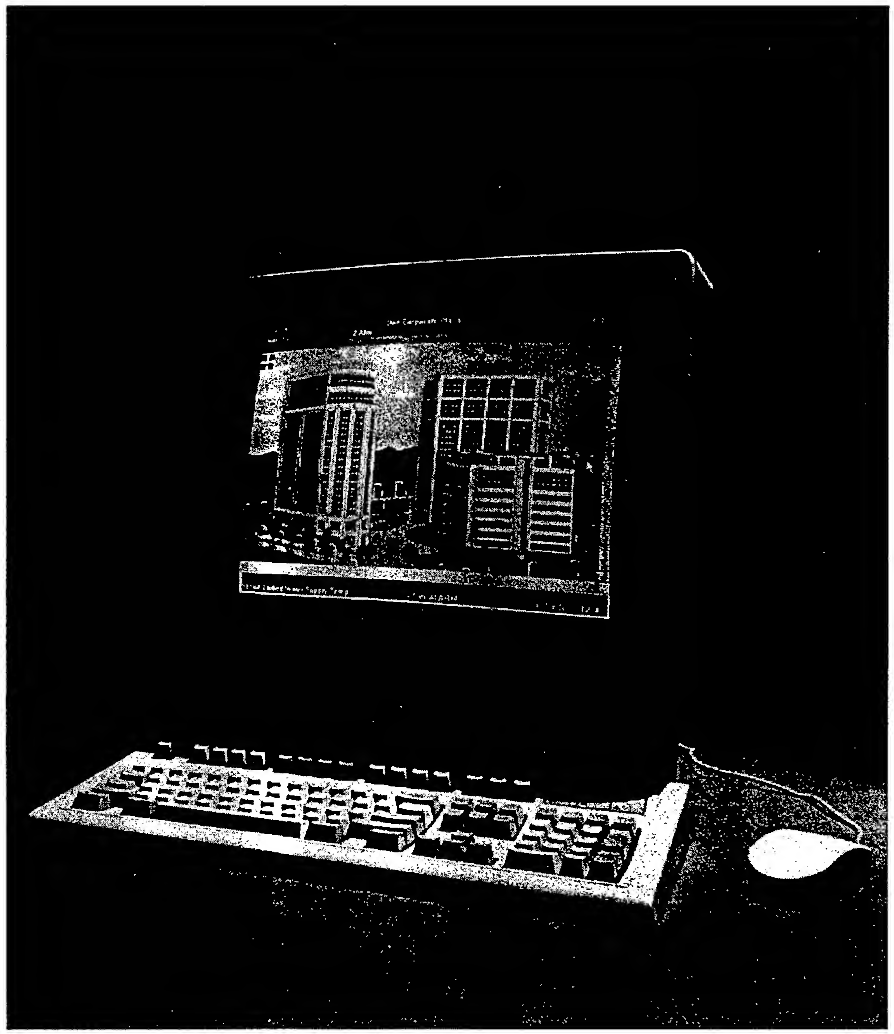
LIT-SB-005 3-93

Literature Type	Product Brief
Literature Number	LIT-PB-001
Date	January 1992
Supersedes	New

Electronic Systems USA, Inc.

UNITY, The Multi-Vendor Platform

- Integrates field equipment from a variety of manufacturers.
- Utilizes IBM's latest OS/2 Multi-Tasking operating system.
- Totally graphic based operator interface requires no computer experience.
- Energy Management, Fire/Life Safety and Security integrated into one manageable system.
- MEA, CSFM and UL listed 864/1076 UOJZ for fire and security applications.
- Expandable with the latest Direct Digital Control (DDC), Intelligent Access Control and Analog Fire systems.
- Exclusively features the "Logical Group Tree," a technological breakthrough developed by Electronic Systems USA.
- Operates on standard off-the-shelf PC hardware and software.



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UNITY, The True Multi-Vendor Solution

Another First From Electronic Systems USA

UNITY is the latest in a family of PC based automation front-ends from the recognized leader in Multi-Vendor solutions. UNITY is the only Multi-Vendor software based system that can successfully integrate Fire/Life Safety, Security and Energy Management applications. UNITY is UL Listed under category 864/1076, along with MEA and CSFM for Fire/Life Safety, Security and Energy Management.

Bringing Leading Edge Technology To Your Facility

While the automation industry awaits a solution from BACNET to solve their multi-vendor dilemma, UNITY is already installed and operational in some of the most prestigious buildings in the United States and abroad.

UNITY combines a powerful 80386 or 80486 based personal computer with IBM's advanced Operating System/2 (OS/2) multi-tasking system. The combination offers you the most powerful and flexible front-end replacement available today.

What Does Multi-Vendor Mean To You?

UNITY's Multi-Vendor capabilities mean freedom. Freedom to break away from the sole-source lock-in associated with many manufacturer's field equipment. Multi-Vendor also means power. By integrating several manufacturers' systems for Direct Digital Control, Intelligent Access Control and Addressable Fire applications into one system, UNITY puts the power of choice back in your hands.

A Proven System Backed By A Proven Company

UNITY proudly boasts a growing list of satisfied users. Selected by many outstanding Fortune 100 corporations, UNITY is operational in some of the most prestigious buildings around the world. The list includes the world's tallest office building, world headquarters of America's largest telecommunications corporation, as well as the tallest multiple-building hotel/office complex in the United States.

UNITY is currently controlling a wide variety of facilities including government buildings, hospitals, universities, commercial buildings and nuclear power plants. Electronic Systems USA has proven its expertise in system upgrades and Multi-Vendor solutions by installing its systems in hundreds of buildings throughout the world.

Electronic Systems USA, Inc. — The Recognized Leader in Third Party Building Automation Maintenance, Products and Support

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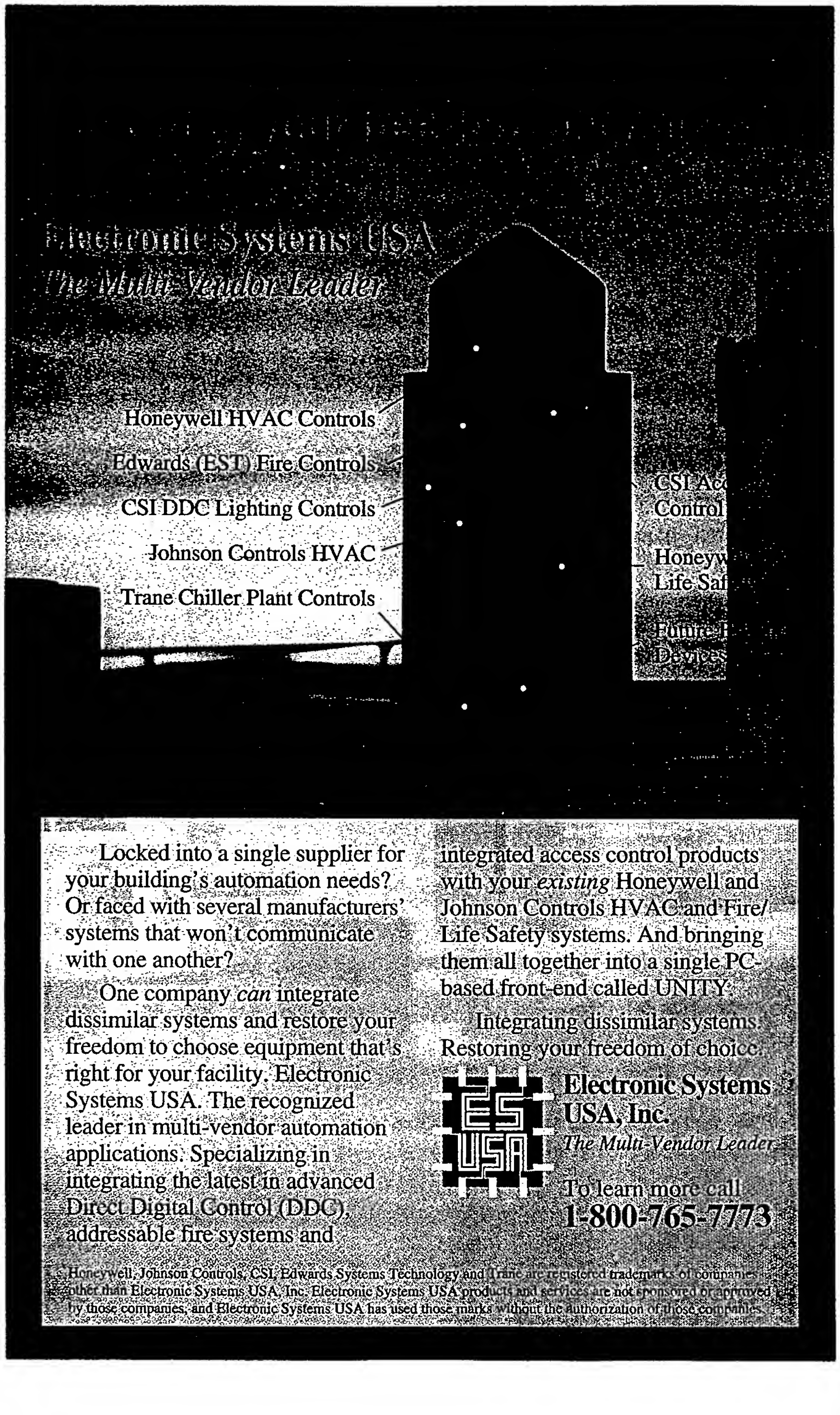
Electronic Systems USA Leads the Multi-Vendor Charge!

Electronic Systems USA, the nation's leading supplier of multi-vendor products and services in the building automation industry, specializes in integrating the latest technology with your existing system, thus *protecting your original investment.*



Automation Upgrade Services.
Electronic Systems USA can integrate major manufacturers' HVAC, Fire/Life Safety and Security systems into a single PC-based front end. Plus integrate the latest in advanced Direct Digital Control (DDC), distributed card access and addressable fire alarm products. This leading edge technology is only available through a revolutionary product called UNITY. A PC-based front end replacement, UNITY features a Graphic User Interface, eliminating cumbersome programming languages. UNITY is UL listed for fire and security applications and runs under IBM's OS/2 multi-tasking operating system, supporting Arcnet, Ethernet, Token Ring and other LAN configurations, as well as DOS and Windows applications.

Customized Maintenance Services.
Through the exclusive Premier-Flex program, system owners can tailor a service agreement to meet the specific needs of their facility. Preventive maintenance, 24-hour, 7-day emergency response, and hardware and software system support services are available. Electronic Systems USA holds a national listing with Underwriters Laboratories, Inc., and can issue UL Certificates of Compliance for NFPA 72 series standards.

Component and Repair Services.
Electronic Systems USA maintains a large inventory of new and reconditioned parts for major manufacturers' automation systems. And a state-of-the-art circuit board repair lab with full diagnostic testing equipment. All repaired parts are backed by an exclusive 2-year warranty—twice the standard industry warranty.

Comprehensive Training.
Electronic Systems USA has been supporting system owners with the finest third party training in the industry since 1979. Qualified instructors offer a customized, "hands-on" approach to maintenance and programming courses. Instruction is available on-site, or at the Corporate Training Center in Louisville, Kentucky.

Find out how you can protect your original investment! Call Electronic Systems USA today at **(800) 765-7773**.

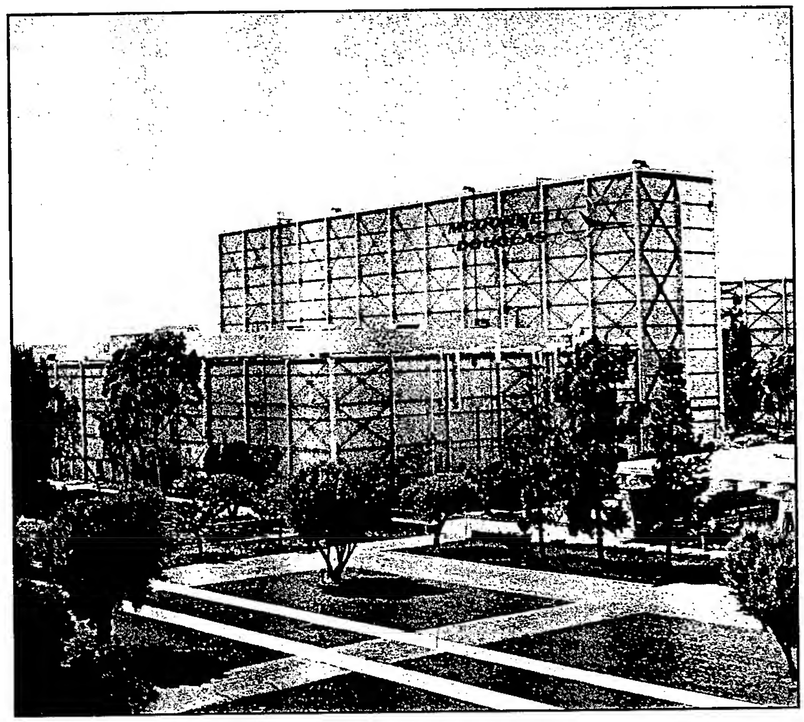
Electronic Systems USA, Inc.

The Multi-Vendor Leader

Profile

McDonnell Douglas Aerospace Center

McDonnell Douglas Aerospace Exceeds Energy Savings Projections by 81%



McDonnell Douglas Aerospace, headquartered in Huntington Beach, California, is a three and a half million square foot, multi-building facility housing its Space and Defense Systems business unit. The nation's leading defense contractor relies on the proven qualities of excellence, innovation and experience as they continue to meet the challenges of the 21st century, bridging the gap between concept and hardware to establish the world's future in space.

As the entire country felt the pinch of a declining economy in 1991 and 1992, McDonnell Douglas Aerospace began looking for ways to reduce spending. The facility's HVAC systems came under immediate scrutiny.

The facility's main complex houses 60 air handling units that were operating 24 hours per day. The main complex was originally controlled by a Honeywell Delta 1000 system. In a separate 8-story office building, two stand-alone Honeywell Excel DDC (direct digital control) panels and a hand-held display device were used for monitoring and calculating the building's field data.

The configuration of equipment at McDonnell Douglas presented specific problems. The McDonnell Douglas staff struggled with the system's difficult programming language (CIL), and spent thousands of dollars trying to keep system calculations accurate and equipment operational. They had an annual maintenance contract with Honeywell, but it did not cover the cost of emergency service or spare parts for the entire system.

The facility began its mission to bring energy spending under control by researching available solutions for modernizing the McDonnell Douglas Aerospace automation systems. Ultimately, Electronic Systems USA, Inc., and their front-end replacement product, UNITY, was selected to accomplish the modernization. UNITY provided McDonnell Douglas with the optimum solution by upgrading the current system without replacing the field equipment, such as data gathering panels, wiring, sensors, etc. UNITY also provided a multi-vendor, PC based platform for controlling the facility.

Financing for the project was secured by presenting some impressive figures to demonstrate a three month return on investment:

- With the UNITY system, Honeywell's maintenance agreement could be reduced to $25,000 per year.

- Labor and overtime could be reduced substantially.

- McDonnell Douglas Aerospace could realize $129,000 per year in energy savings.

- A $20,000 rebate could be realized through the Utility Rebate Program of Southern California Edison.

UNITY was installed to replace the Delta 1000 front-end, and the Excel panels in the 8-story building were replaced with new Direct Digital Control panels and tied into the UNITY system. System operators were then able to program their own energy management strategies, such as an Optimum Start/Stop program to maximize usage of the 60 air handling units during peak hours. Integrating the field points from the 8-story building into the central system also simplified control and monitoring strategies.

One year after the UNITY system was installed, the engineering staff proudly reported that McDonnell Douglas Aerospace had exceeded its original energy savings projections:

- As a result of UNITY's ease of programming and operation, the Honeywell maintenance agreement of $38,000 per year was totally eliminated.

- Labor and overtime expenditures were reduced by $135,000 per year.

- The energy savings realized were over $233,000 per year, netting a rebate of greater than $31,000 from Southern California Edison.

Retrofit of the McDonnell Douglas Aerospace facility with UNITY from Electronic Systems USA, along with meticulous planning and implementation netted the following:

- A 60-day payback

- 81% greater energy savings than originally projected

- A utility rebate that exceeded projections by 59%

The retrofit at McDonnell Douglas Aerospace was not only completed on budget, it also realized outstanding labor savings and generated tremendous energy savings.

McDonnell Douglas exceeded their original savings projection by 81% within one year of the UNITY installation

UNITY has the ability to integrate not only dissimilar systems (Delta 1000 and Excel), but also different manufacturers' equipment (Honeywell, Johnson Controls, Landis & Gyr Powers, Control Systems International, Edwards Systems Technology, Trane, etc.) into a PC based operating system. This presents a major advantage in freeing a facility from obligation to the original equipment manufacturer for upgrades, parts and service, and also opens up opportunity for competitive bids on future expansions. UNITY features a Graphic User Interface, which allows easy access and control with minimal computer experience. The system eliminates CIL programming and replaces it with English language for energy management programming to implement strategies. UNITY operates on standard off-the-shelf PC equipment, which provides many avenues for product support.

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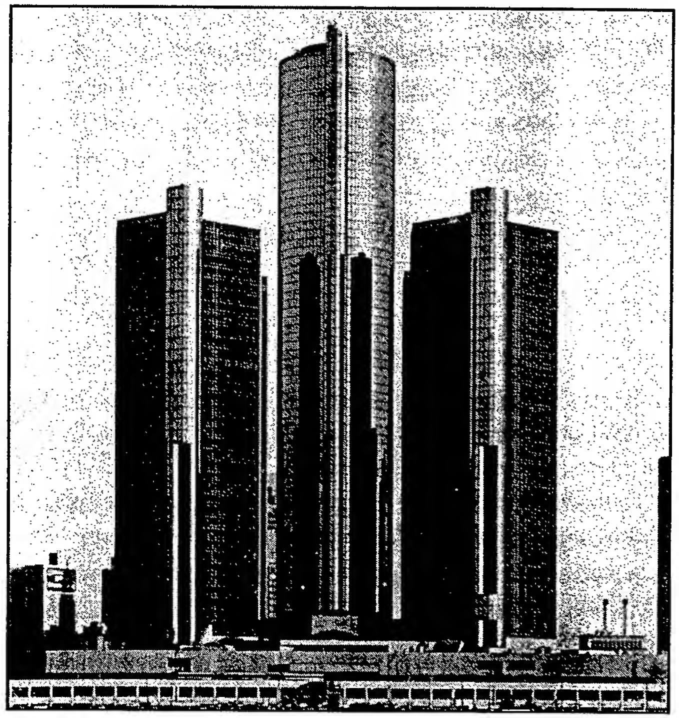
The Multi-Vendor Leader

Profile

Renaissance Center, Detroit

UNITY Gives Renaissance Center Freedom of Choice



Through the vision of Henry Ford II, Renaissance Center is a six tower complex centered around the tallest hotel in North America, a 73-story Westin Hotel. Renaissance Center incorporates more than five and a half million square feet of commercial and hotel space. The complex requires one of the largest commercial central cooling plants in the world, with over 14,000 tons of cooling capacity.

Operating a facility of this magnitude posed serious problems as the installed systems began to age. The original building automation system installed at Renaissance Center was a combination of Honeywell Delta 2000, Delta 1000 and Excel DDC equipment. The 8,000 field points comprising Renaissance Center utilized the most complex combination of Honeywell control interpreter language (CIL) programming ever installed to control HVAC applications. Extreme difficulty in working with the CIL programming software prohibited integrating new energy management strategies required to operate efficiently. The highly customized system required Renaissance Center to rely solely on Honeywell for system expansions, eliminating a competitive bid situation.

Faced with outdated technology, and virtually no software documentation to support the highly customized system, Renaissance Center, along with the outside accounting and finance firm, Coopers and Lybrand, conducted an expansive study to upgrade the building's automation systems with state-of-the-art technology.

After a 2-year evaluation, Electronic Systems USA was selected for the upgrade, on the basis of their outstanding reputation as a multi-vendor

systems integrator. Renaissance Center selected Electronic Systems USA and their powerful, PC based front-end replacement, UNITY, for their ability to offer proven, cost effective solutions.

The initial project involved integrating the existing Honeywell equipment (Delta 2000, Delta 1000 and Excel) into a single operating system. Electronic Systems USA successfully accomplished the task by replacing the old generation front-end with a UNITY system capable of full protocol communication to the field. This type of architecture allowed the field equipment to remain in place and communicate to the new front-end. Careful planning and execution of the installation resulted in minimal downtime for Renaissance Center.

The second stage of the project involved a retrofit of the Renaissance Center chiller plant. The chiller plant presented an interesting challenge, since virtually all controls were operated manually from the original installation. Electronic Systems USA engineers worked extensively with Renaissance Center personnel to achieve their goals of state-of-the-art equipment, smooth installation and budget adherence.

The chiller plant was retrofitted with automated controls and tied into the UNITY system. The project was bolstered by a utility rebate from Detroit Edison, based on a 2-year payback.

While numerous DDC vendors offered equipment which would meet the general applications required of the 14,000 ton chiller plant, the combination of Control Systems International (CSI) equipment and the UNITY front-end proved superior. The configuration enabled Electronic Systems USA and Renaissance Center staff to initiate advanced control strategies that will have long-term benefits for the facility.

One such strategy is aimed at reducing kilowatt usage in order to avoid demand charges from Detroit Edison, the local utility. By designating on/off points within the CSI subsystem for demand control, UNITY is able to monitor the point data, analyze it, and initiate demand strategies to perform opposing tasks, such as shutting off unnecessary air handler units.

The UNITY system has also enabled the engineering staff at Renaissance Center to implement control strategies that monitor solar load and initiate an optimization schedule for pump sequencing that resets the differential pressure to control the flow of chilled water throughout the facility. The chiller plant has nine pumps that control the flow of chilled water throughout the facility. This strategy results in an automatic pump selection based on averaged run time rather than a set sequence. The result is reduced maintenance costs and extended life of the equipment.

UNITY now provides seamless integration of the existing Honeywell equipment into a multi-vendor platform, operating on standard off-the-shelf hardware. The new front-end is easily maintained, eliminates proprietary control languages, and simplifies programming new energy management strategies.

The UNITY system also enabled Renaissance Center to integrate and expand with advanced Direct Digital Control technology without relying on the original HVAC equipment manufacturer.

Electronic Systems USA was able to provide long-term solutions for Renaissance Center. The facility operates more efficiently, and remains independent of equipment manufacturers for product support. UNITY's architecture gives Renaissance Center the benefit of opening their facility to competitive bid on future expansions. And they are free to maximize operations through the implementation of energy management strategies.

UNITY truly gives Renaissance Center freedom of choice!

Renaissance Center houses one of the largest central cooling plants in the world, and represents one of the most complex system retrofits ever undertaken.

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FEDERAL AVIATION ADMINISTRATION

ESUSA was selected through the bid process to upgrade 26 Air Route Traffic Control Centers (ARTCC) across the United States. The FAA wanted a computer-based front-end system that could monitor and control critical mechanical and environmental subsystems within the air traffic radar centers. ESUSA's first generation Honeywell CPU replacement, the Building Control Console, was chosen.

Each ARTCC is between 80,000 and 100,000 square feet and uses approximately 20 Delta 2500 Data Gathering Panels (DGPs). While the Delta 2500 could perform duty cycling and limited optimum start/stop, there was no way for the user to expand control strategies or add new algorithms for additional control points without sending data back to the factory. In addition, parts were very difficult to obtain.

While the BCC is not Direct Digital Control (DDC), it does allow on-site programming, as well as expanded control options such as load shedding, temperature-compensated duty cycling, more sophisticated chiller and boiler optimization, and lighting control. The BCC also came with color graphics, multi-tasking software and trending report capabilities.

Because the project was a federal government installation, the vendor was selected on the basis of low bid. Other bidders were Honeywell, which offered its Excel Plus system at $1.8 million, and Optimum Controls Corp., Reading Valley, PA, which bid its Optimum 9000 system at $1.9 million. ESUSA's winning bid was $1.2 million.

ESUSA is currently integrating CSI DDC to the BCC in many of these sites. The southwest region has standardized with the CSI System 7000 for its DDC needs.

Contact: Sid Wibbels
Louisville

PROPERTY MANAGEMENT REFERENCES
(Partial list)

John Buck Company	Sears Tower	Chicago
LaSalle Property Management	O'Hare Plaza	Chicago
Cushman & Wakefield	One Rotary Center	Chicago
Premisys R.E. Management	Citicorp Plaza	Los Angeles
LaSalle Property Management	Fox Plaza	Los Angeles
MS Management Services	Security Pacific	Los Angeles
CB Commercial	12100 Wilshire Blvd.	Los Angeles
Charles Dunn Company	University Towers	Los Angeles
Premisys R.E. Management	Gateway Center	Newark, NJ
LaSalle Property Management	NationsBank Plaza	Charlotte
Galbreath Company	Mobil Oil Building	Dallas
Brookfield Development	World Trade Center	Denver

APPENDIX I
SCOPE OF WORK

CESAM-EN-CM

January 1993

GENERAL SCOPE OF WORK

FOR A

LIMITED ENERGY STUDY

FOR

ENERGY MANAGEMENT STUDY

FORT BELVOIR, VA

Performed as part of the

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

SCOPE OF WORK
FOR A
LIMITED ENERGY STUDY

TABLE OF CONTENTS

ANNEXES

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

~~1.1~~ Review the previouslv ... Engineering Analysis Program (EEAP) st... ...the specific building, system, or ene OMIT .. opportunity (ECO) covered by this study.

1.2 Perform a limited site survey of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.

~~1.3~~ Reevaluate the spec... r ECO from the previous study to determin OMIT ...ility based on revised criteria, current si ... and technical applicability.

1.4 Evaluate specific ECOs to determine their energy savings potential and economic feasibility.

1.5 Provide project documentation for recommended ECOs as detailed herein.

1.6 Prepare a comprehensive report to document all work performed, the results and all recommendations.

2. GENERAL

2.1 This study is limited to the evaluation of the specific buildings, systems, or ECOs listed in Annex A, DETAILED SCOPE OF WORK.

2.2 The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.

~~2.3~~ For the buildings, system... ECOs listed in Annex A, all methods of energy conservation ...e reasonable and practical shall be considered, inclu... ...ovements of operational methods and procedures as well ...physical facilities. All energy conservation opportun OMIT ...ch produce energy or dollar savings shall be docum... . this report. Any energy conservation opportunity consider ...infeasible shall also be documented in the report with reasons for elimination.

~~2.4~~ The study OMIT use of all energy sources applicable to each ... ...ystem, or ECO.

2.5 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from CEHSC-FU, dated 4 Nov 1992 and the latest revision from CEHSC-FU establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. The program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. If any program other than LCCID is proposed for life cycle cost analysis, it must use the mode

of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval to the Contracting Officer.

2.6 Computer modeling will be used to determine the energy savings of ECOs which would replace or significantly change an existing heating, ventilating, and air-conditioning (HVAC) system. The requirement to use computer modeling applies only to heated and air-conditioned or air-conditioned-only buildings which exceed 8,000 square feet or heated-only buildings in excess of 20,000 square feet. Modeling will be done using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The program will use established weather data files and may perform calculations on a true hour-by-hour basis or may condense the weather files and the number of calculations into several "typical" days per month. The Detailed Scope of Work, Annex A, will list programs that are acceptable to the Contracting Officer. If the AE desires to use a different program, it must be submitted for approval with a sample run, an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities.

2.7 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This will involve combining similar ECOs into larger packages which will qualify for ECIP, funding, and determining in coordination with installation personnel the appropriate packaging and implementation approach for all feasible ECOs.

2.7.1 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).

2.7.2 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

2.7.3 At some installations Energy Conservation and Management (ECAM) funding will be used instead of ECIP funding. The criteria for each program is the same. The Director of Engineering and Housing will indicate which program is used at this installation. This Scope of Work mentions only ECIP, however, ECAM is also meant.

3. <u>PROJECT MANAGEMENT</u>

3.1 <u>Project Managers</u>. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be

responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

Mr. Mike Stambaugh, Energy Conservation Coordinator (423) 826-

3.2 Installation Assistance. The Commanding Officer or authorized representative at the installation will designate an individual to assist the AE in obtaining information and establishing contacts necessary to accomplish the work required under this contract. This individual will be the installation representative.

3.3 Public Disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE's project manager and the Government's representative shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7 Interviews. The AE and the Government's representative shall conduct entry and exit interviews with the Director of Engineering and Housing before starting work at the installation

and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.

3.7.1 Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from the Director of Engineering and Housing.

3.7.2 Exit. The exit interview shall briefly describe the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the Director of Engineering and Housing.

4. <u>SERVICES AND MATERIALS</u>. All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. <u>PROJECT DOCUMENTATION</u>. All energy conservation opportunities which the AE has considered shall be included in one of the following categories and presented in the report as such:

5.1 <u>ECIP Projects</u>. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $300,000, a Savings to Investment Ratio greater than one and a simple payback period of less than ten years. For ECAM projects, the $300,000 limitation may not apply; in such cases, the AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have an SIR greater than one. All projects meeting the above criteria shall be arranged as specified in paragraph 2.7.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. [For projects and ECOs reevaluated from previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment

of work under which the project or ECO was developed in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. The purpose of this information is to provide a means to prevent duplication of projects in any future reports.]

5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate or payback period, but which have an SIR greater than one shall be documented. Projects or ECOs in this category shall be arranged as specified in paragraph 2.7.2 and shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, ie, energy savings calculations and cost estimate(s), and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost greater than $3,000 but less than $100,000 and a simple payback period of two years or less.

b. Productivity Enhancing Capital Investment Program (PECIP). This program is for projects which have a total cost of greater than $3,000 but lees than $100,000 and a simple payback period of four years or less.

c. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost of more than $100,000 and a simple payback period of four years or less.

The above programs and the required documentation forms are all described in detail in AR 5-4, Change No. 1.

d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $300,000 and a simple payback period of four to twenty-five years. Documentation shall consist of DD Form 1391 and a Project Development Brochure.

e. Low Cost/No Cost Projects. These are projects which the Director of Engineering and Housing (DEH) can perform using his resources. Documentation shall be as required by the DEH.

f. These projects shall be combined for ECIP. funding

5.3 Nonfeasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK. The Detailed Scope of Work is contained in Annex A.

7. WORK TO BE ACCOMPLISHED.

~~7.1~~ Review Previous Studi-   ew the previous EEAP study which applies to the spec-   ..ng, system, or ECO covered by this study. This re-   .. acquaint the AE with the work that has been perfor- OMIT ..sly. Much of the information the AE may need to devel.   ..COs in this study may be contained in the previous stud .

7.2 Perform a Limited Site Survey. The AE shall obtain all necessary data to evaluate the ECOs or projects by conducting a site survey. However, the AE is encouraged to use any data that may have been documented in a previous study. The AE shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrated prior to its use.

~~7.3~~ Reevaluate Selected Projects. The AE shall reevaluate the projects and ECOs listed in Annex A. - ese are projects and ECOs that the previous study has ide-   but that have not been accomplished or only parts have -   ..mplished. If the project or ECO is acceptable as is, -   chere are no changes to the basic project or ECO, th-   savings shown in the previous project may be accep- OMIT ..curate but the energy cost and construction cost e-   shall be updated based on the most current data availa-   With the above information the project shall then be analyzed based on current ECIP criteria. If the project or ECO is basically acceptable but some of the buildings in the original project have been deleted or new buildings can be added, the necessary changes shall be made to the energy savings, the energy costs and construction costs shall be updated, and the revised project or ECO shall then be analyzed using current ECIP guidance. If the original project or ECO has had numerous changes made to it so that all of the numbers are suspected of being inaccurate, but the project or ECO is still considered feasible, the AE shall develop the project from the beginning and analyze it with the current ECIP guidance. These projects shall be separately listed in the report.

7.4 Evaluate Selected ECOs. The AE shall analyze the ECOs listed in Annex A. These ECOs shall be analyzed in detail to determine their feasibility. Savings to Investment Ratios (SIRs) shall be determined using current ECIP guidance. The AE shall provide all data and calculations needed to support the recommended ECO. All assumptions and engineering equations shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data.

7.5 Combine ECOs Into Recommended Projects. During the Interim Review Conference, as outlined in paragraph [7.6.1], the AE will be advised of the DEH's preferred packaging of recommended ECOs into projects for implementation. Some projects may be a combination of several ECOs, and others may contain only one. These projects will be evaluated and arranged as outlined in paragraphs 5.1, 5.2, and 5.3. Energy savings calculations shall take into account the synergistic effects of multiple ECOs within a project and the effects of one project upon another. The results of this effort will be reported in the Final Submittal per par [7.6.2].

7.6 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included. The AE shall give a formal presentation of the interim submittal to installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. It is anticipated that the presentation and review conference will require approximately one working day. The presentation and review conference will be at the installation on the date agreeable to the Director of Engineering and Housing, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.6.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The results of the ECO analyses shall be summarized by lists as follows:

a. All ECOs eliminated from consideration shall be grouped into one listing with reasons for their elimination as discussed in par 5.3.

b. All ECOs which were analysed shall be grouped into two listings, recommended and non-recommended, each arranged in order of descending SIR. These lists may be subdivided by building or area as appropriate for the study.

The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. At the Interim Submittal and Review Conference, the Government's and AE's representatives shall coordinate with the Director of Engineering and Housing to provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.6.2 Final Submittal. The AE shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The AE shall submit the Scope of Work for the study and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The lists of ECOs specified in paragraph [7.6.1] shall also be included for continuity. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The final report shall be arranged to include:

a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex B for minimum requirements).

b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.

c. Documentation for the recommended projects (includes LCCA Summary Sheets).

d. Appendices to include as a minimum:

1) Energy cost development and backup data

2) Detailed calculations

3) Cost estimates

4) Computer printouts (where applicable)

5) Scope of Work

MAY 17 1993

APPENDIX A

ENERGY MANAGEMENT SYSTEM (EMS) STUDY
SCOPE OF WORK

1. Purpose. The Architect/Engineer (AE) shall analyze three types of energy management systems for five representative buildings in order to recommend a definitive strategy for the installation.

2. Buildings to be Evaluated. The study population consists of five buildings:

a. Building 3136 (14,110 SF)

b. Building 1425 (15,570 SF)

c. Building 200 (26,850 SF)

c. Building 219 (31,270 SF)

d. Building 247 (148,067 SF)

2. Energy Management System (EMS) Evaluation. The AE shall audit the existing FM switch EMS, studying the specifications and determining the remaining potential. Changes to the current strategy will be recommended if applicable. The AE shall research existing PowerLine Carrier (PLC) and Direct Digital Control (DDC) systems available on the market. Each type EMS must be compared to the others for the five representative buildings.

3. Building Audits. The AE shall audit the electrical and mechanical systems and the heat gain/loss characteristics for each building above. The audit shall include the information needed to evaluate each EMS. Evaluation shall be in terms of cost savings (including demand) and energy savings.

4. Energy Conservation Opportunities (ECOs). The AE shall determine the optimum type of EMS to install in the buildings listed above. Cost savings and energy savings shall be quantified for each building. The pros/cons of each system shall be qualified for each building.

a. FM Switch System. The AE shall evaluate the cost/benefit of including additional buildings on the current system. The current strategy may be continued or may be modified if appropriate.

b. Powerline Carrier System. The AE shall evaluate the cost/benefit of installing a powerline carrier system as the EMS. The strategy will be recommended for each building.

c. Direct Digital Control (DDC) Energy Management System. The AE shall evaluate the cost/benefit of installing a DDC system as the EMS. The strategy will be recommended for each building.

5. **ECO Analysis**. The ECOs listed above shall be analyzed against the existing conditions for each building. Each ECO shall be analyzed individually, per building listed in paragraph 2 above, for cost savings (including demand) and energy savings using ECIP criteria. The program simulation method used for the analyses shall be approved by the Installation.

6. **Market Analysis**. A market analysis shall be conducted to determine efficient and reliable products to successfully realize the potential of each ECO. At least one system shall be recommended for each ECO evaluated. Price information and specifications shall be provided. Generalities shall be unacceptable. The factors leading to each selection shall be documented.

7. **Extrapolated Results**. The conclusions and recommendations of this study will be extrapolated by the Government over the installation building population. The AE shall provide and explain the parameters under which such a projection will have validity. An overall EMS strategy shall be recommended.

8. **Submittals**. The work accomplished shall be fully documented in a comprehensive report. The report shall have a table of contents and have appendices. All pages shall be numbered, including the appendices. The AE shall provide calculations needed to support all data presented. The calculations shall be an orderly step-by-step progression from the first assumption to the final number, showing how all numbers in the analysis were developed.
All assumptions shall be clearly stated. Descriptions of the products, catalog cuts, pertinent drawings, and sketches shall also be included. Each submittal shall consist of five (5) copies, four bound and one (1) in a three ring binder.

a. Interim Submittal. The interim report shall present the work that has been accomplished to date, illustrate the methods and justifications of the approaches taken, and contain a plan for completing the remaining work.

b. Prefinal Submittal. The prefinal report shall be a comprehensive document detailing the analyses performed under this contract and the logical conclusions.

c. Final Submittal. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. Pen and ink changes or errata sheets will not be acceptable. The program simulation shall be submitted as a part of the final submittal on either 3.5 or 5.25 inch disk(s).

d. Comments. Government comments to all submittals, except the final submittal, will be delivered to the AE in written form. The Government will require two weeks to review each submittal. Meetings will be scheduled as necessary to discuss those comments that the AE does not concur with or does not understand.

9. Interviews. The AE shall conduct entry and exit interviews with representatives from the Directorate of Engineering and Housing before starting work at the installation and after completion of the prefinal submittal. The interviews shall be scheduled at least one week in advance.

a. Entry. The entry interview shall thoroughly brief and describe procedures for the study and shall be conducted prior to commencing work on the study.

b. Exit. The exit interview shall summarize the work performed and present the conclusions and recommendations.

10. Services and Materials. All services, materials, labor, and travel necessary to perform the work and render the data required under this contract are included in the lump sum of the contract.

11. Deliverables.

a. Interim Submittal. 90 calendar days from date of receipt by the AE firm of the delivery order.

b. Prefinal Submittal. 45 calendar days from date of receipt by the AE firm of review comments on interim submittal.

c. Final Submittal. 14 calendar days from receipt by the AE firm of review comments on the prefinal submittal.

d. Government Review Time. Government review and comments on the interim submittal will normally take one to two weeks.

12. Computer Modeling

~~If it is possible that~~ The buildings in this study will be subject to the computer modeling requirements of paragraph 2.6, ~~then the~~ ~~simulation programs acceptable to the office doing the technical review should be listed in the detailed scope of work.~~ Some acceptable simulation programs follow:

a. Building Loads and System Thermodynamics (BLAST) *

b. DOE 2.1B *

c. Carrier E20 or Hourly Analysis Program (HAP) **

d. Trane Air-Conditioning Economics (TRACE) **

e. "A computer program titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The AE is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. The telephone number is (217) 333-3977 or (800) 842-5278."

13. Government Furnished Information:

* (1) ETLs 1110-3-254, Use of Electric Power for Comfort Space Heating (if applicable), and 1110-3-282, Energy Conservation

* (2) Architectural and Engineering Instructions.

* (3) Energy Conservation Investment Program (ECIP) Guidance, dated 4 Nov 1992 and the latest revision with current energy prices and discount factors for life cycle cost analysis.

* (4) TM 5-785, Engineering Weather Data, TM 5-800-2, General Criteria Preparation of Cost Estimates.

* (5) AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program.

* (6) AR 415-15, 1 Jan84, Military Construction, Army (MCA) Program Development

* (7) The latest MCP Index.

14. Facility Assistance Representative

Mr Mike Strimbaugh
Energy Coordinator
703 806-4007

ANNEX B

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.

2. Building Data (types, number of similar buildings, sizes, etc.)

3. Present Energy Consumption of Buildings or Systems Studied.

   o Total Annual Energy Used.

   o Source Energy Consumption.

     Electricity - KWH, Dollars, BTU
     Fuel Oil - GALS, Dollars, BTU
     Natural Gas - THERMS, Dollars, BTU
     Propane - GALS, Dollars, BTU
     Other - QTY, Dollars, BTU

4. Reevaluated Projects Results.

5. Energy Conservation Analysis.

   o ECOs Investigated.

   o ECOs Recommended.

   o ECOs Rejected. (Provide economics or reasons)

   o ECIP Projects Developed. (Provide list)*

   o Non-ECIP Projects Developed. (Provide list)*

   o Operational or Policy Change Recommendations.

   * Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.

6. Energy and Cost Savings.

   o Total Potential Energy and Cost Savings.

   o Percentage of Energy Conserved.

   o Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

ANNEX C

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects as "ECIP."

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

g. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

j. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and (3) an economic analysis supporting the specific retrofit.

k. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

l. Any requirements required by ECIP guidance dated 4 Nov 1992 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

m. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

APPENDIX J
MEETING MINUTES

Einhorn
Yaffee
Prescott

ARCHITECTURE &
ENGINEERING, P.C.

Minutes of Meeting

Project Name:	Ft. Belvoir Energy Management Study
Project Number:	60692.00
Date of Meeting:	10/14/93
Time of Meeting:	1:30 p.m.
Location of Meeting:	Ft. Belvoir Bldg. 1442
Meeting Number:	1

To:
Directorate of Public Works
Environmental and Natural Resources Division
9430 Jackson Loop
Ft. Belvoir, VA 22060-5130
ATTN: Mike Stumbaugh
Contract No. DACA31-92-D-0061
Delivery Order 0004

Purpose of Meeting:

To establish complete product scope and define expectations of all parties involved.

Attendees:	Representing:
Mike Stumbaugh	Ft. Belvoir
Kevin Eskandary	Einhorn Yaffee Prescott
Steve Maskell	Einhorn Yaffee Prescott
Julius Stone	Einhorn Yaffee Prescott
Frank Ebbert	Einhorn Yaffee Prescott
David Smith	Einhorn Yaffee Prescott

The following constitutes my understanding of the items discussed and the decisions reached. If there are any additions or corrections, please contact the undersigned:

cc: Attendees
Jim Hawk, CENAB

Signed: DAll

Date: 10/15/93

THE FLOUR MILL 1000 POTOMAC STREET, NW WASHINGTON, DC 20007-3238 (202) 471-5000

Minutes of Meeting

Subject	Decision/Action Summary
Existing FM Switch EMS	Mr. Stumbaugh stated that the existing FM switch EMS could be evaluated by visiting Building 191, where it is currently installed and talking with the operating personnel at that building. Mr. Stumbaugh will provide contact name and number and arrange a meeting between the operating personnel and an EYP representative.
Type of Heating Fuel	Mr. Stumbaugh indicated that the base currently uses fuel oil for most of its heating needs but an up grade to gas was underway. He also indicated that for purposes of this study the heating costs are to be calculated using gas as the fuel. Mr. Stumbaugh will provide to EYP the gas rates which will be applied to this study.
Use of Fiber Optics	Mr. Stumbaugh indicated that the existing fiber optics network which is currently in operation at Ft. Belvoir is to be used for all inter-building EMS data transmission where possible. He will provide to EYP a contact name and phone number for Harris Corporation which maintains the fiber optic network.
Scope of EMS Study	Mr. Eskandary stated that energy savings could possibly be realized by including building and site lighting in the EMS scope and asked if this should be addressed in the study. Mr. Stumbaugh stated that the primary area to be investigated was the heating, ventilating, and air conditioning (HVAC) systems and that site lighting is currently controlled by photo-cell controls and was to remain as such. It was agreed that any potential savings regarding EMS control of lighting would be discussed within the text of the report but would not be included in the economic analysis of the systems. Mr. Smith asked if the auditorium (building 219A) adjacent to building 219 was to be included in the scope of this study. Mr. Stumbaugh indicated that building 219A was to be included. Mr. Eskandary inquired as to the extent of control diagrams expected to be included in the report. Mr. Stumbaugh stated that the report should include schematic diagrams showing the general scheme of the system being proposed for each building.
Computer Modeling	Mr. Smith proposed two possible programs to be used in model the building energy consumption. These programs are <u>Carrier E20-II</u> and <u>ASEAM 3.0</u>. Mr. Stumbaugh stated that he was

Minutes of Meeting

Subject	Decision/Action Summary
	familiar with both programs and that either was acceptable to him for use in this study. Mr. Smith indicated that he would notify Mr. Stumbaugh in the near future as to which program would be used.
Schedule	The schedule for the project was discussed and Mr. Stumbaugh indicated that the schedule was to be as outlined in the original scope of work with the starting date being October 14, 1993.
Site Surveys	Mr. Stumbaugh indicated that access would be available without clearance to all buildings except building 3136 which is a secure area and would require prior clearance. Mr. Stumbaugh is to arrange for acquisition of necessary clearance for building 3136. Mr. Stumbaugh is to provide to EYP a list of contact names and phone numbers of personnel in each building. These persons are to be interviewed by EYP to determine the current operating hours and procedures for each building.
Electric Rates	Mr. Stumbaugh indicated that the electric service was provided to the base by Virginia Power in the form of a large primary service and was billed as such. He is to provide to EYP the electric billing information for the past year for the purposes of establishing current rate structures.
Power Line Carrier Systems	There was a general discussion concerning Power Line Carrier (PLC) systems and the applicability to this study. Mr. Smith indicated that he has contacted several vendors and was in the process of gathering information about PLC systems available today. Mr. Stumbaugh stated that building 1442 had an operating PLC system and that he would provide EYP with information about that system.
Miscellaneous	Mr. Smith requested a copy of the latest Energy Conservation Investment Program (ECIP) guidelines. Mr. Stumbaugh said he would provide this document to EYP. Mr. Smith asked if there was a particular report format that was preferred and Mr. Stumbaugh indicated that he would provide a copy of a previous study to EYP for reference purposes.

Minutes of Meeting

Project: Ft. Belvoir EMS Study Date: 10/14/93

Subject	Decision/Action Summary
	Mr. Stumbaugh indicated that building 219 was about to undergo a major renovation which was to include an EMS. He said he would provide to EYP information on this project and the EMS which was to be installed.

Einhorn
Yaffee
Prescott

ARCHITECTURE &
ENGINEERING, P.C.

Minutes of Meeting

Project Name:	Ft. Belvoir Energy Management Study
Project Number:	60692.00
Date of Meeting:	12/6/93
Time of Meeting:	9:00 a.m.
Location of Meeting:	Ft. Belvoir Bldg. 1442
Meeting Number:	2

To:
Directorate of Public Works
Environmental and Natural Resources Division
9430 Jackson Loop
Ft. Belvoir, VA 22060-5130
ATTN: Mike Stumbaugh
Contract No. DACA31-92-D-0061
Delivery Order 0004

Purpose of Meeting:

To review report format and confirm correct approach to study.

Attendees:	Representing:
Mike Stumbaugh	Ft. Belvoir
David Smith	Einhorn Yaffee Prescott

The following constitutes my understanding of the items discussed and the decisions reached. If there are any additions or corrections, please contact the undersigned:

cc: Attendees
J. Hawk, CENAB
K. Eskandary, EYP
J. Stone, EYP

Signed: DH

Date: 12/9/93

Minutes of Meeting

Subject	Decision/Action Summary
Review of proposed report outline:	- Mike Stumbaugh commented that the executive summary should include a one page description of recommended projects with all applicable pay-back and return-on-investment figures. This summary should be in tabular form if possible. - David Smith stated that EYP would develop a format for such a table and include that format in the interim submittal. - Mr. Stumbaugh expressed his desire to have the executive summary be as short and concise as possible and that the bulk of the technical information be included in the evaluation section of the report.
Discussion of control system options:	- Mr. Smith explained that there are two basic types of Powerline Carrier Control systems available. One system has two-way communication capabilities and can perform many of the comfort control and energy management functions of a Direct Digital Control System while the other features one-way communication and operates primarily by turning equipment on and off using a series of relays. - It was agreed that because of the simplicity and greater availability of suppliers and technical support, only the one-way system would be considered as part of this study.
Discussion of EMS systems evaluation matrix:	- Mike Stumbaugh requested that reliability and maintainability be added to the evaluation criteria as well as compatibility with existing mechanical equipment. - It was agreed that cost should be added to the evaluation criteria and that the matrix may be best used to evaluate the three EMS options in general and not in their application to each building. Mr. Smith is to further develop the matrix and decide upon the application. - Preliminary schematic diagrams were reviewed and Mike Stumbaugh indicated that the format was acceptable. David Smith commented that these schematics would be refined and revised to accommodate the results of the economic analysis and recommendations from the control vendors.

Minutes of Meeting

Subject	Decision/Action Summary
Miscellaneous:	- Mr. Stumbaugh provided a copy of the specifications for a direct digital EMS that is to be installed in Building 219. - Mr. Smith requested a copy of DD Form 1391 which is to be filled out for all ECIP projects recommended as a result of this study. Mr. Stumbaugh is to obtain and forward a copy of this form to EYP for incorporation into the report. - There will be a building walk-thru with an account manager and a control technician from a control vendor on Friday December 10, 1993 at 1:00 pm. This walk-thru will be attended by Mike Stumbaugh and David Smith and will involve primarily the mechanical rooms of each of the buildings being studied.

Minutes of Meeting

Project Name:	~~Ft. Belvoir Energy~~ Management Study
Project Number:	60692.00
Date of Meeting:	3/24/94
Time of Meeting:	10:00 a.m.
Location of Meeting:	Ft. Belvoir Bldg. 1442
Meeting Number:	3

To:
Mr. Jim Hawk
CENAP AE Acquisition Branch
10 S. Howard Street
Baltimore, MD 21201
COE Project No. DACA31-92-D-0061
Delivery Order No. 0004

Purpose of Meeting:

To review comments on interim submittal.

Attendees:	Representing:
Jim Hawk	COE
Mike Stumbaugh	DPW - Fort Belvoir
Kevin Eskandary	Einhorn Yaffee Prescott
David Smith	Einhorn Yaffee Prescott
Julius Stone	Einhorn Yaffee Prescott

The following constitutes my understanding of the items discussed and the decisions reached. If there are any additions or corrections, please contact the undersigned:

cc: Attendees

Signed: ______________________

I [illegible] to [illegible] the
comment that ~~[illegible]~~ resulted
in the report, [illegible]

Minutes of Meeting

Project: Ft. Belvoir EMS Study   Date: 3/24/94

Subject	Decision/Action Summary
Review of COE Comments	EYP Response: Mechanical 1. Approval by other divisions of the Corp of Engineers (COE) is not within the scope of the contract for this study. This approval will be the responsibility of Fort Belvoir (the Post). 2. The decision to use DDC controls in any of the buildings in this study and the acquisition of any required waiver will be the responsibility of the Post personnel, not the authors of this report. The report will address only the cost/benefit analysis for the various type of EMS. EYP Response: Electrical 1. The program was inadvertently referred to as Version 3.0. The program used was actually Version 3.02. 2. EYP will use data that was shown on the original contract drawings for each building. Where data is not available EYP will estimate the outside air quantities based on known conditions. 3. Mike Stumbaugh indicated that actual change over dates vary from year to year. It was decided that April 15 and September 15 would be used for the purposes of this study. 4. The ECIP Guidelines recommend a ten (10) year Economic Analysis Life for EMS or HVAC Control projects. If any other criteria are to be followed COE must advise. 5. The BLCC life cycle cost analysis program uses data from the NISTIR 85-3273 as required by the ECIP guidelines. Also see the enclosed letter explaining the BLCC program. 6. The 3.1% discount factor is the FEMP discount rate for 1994 listed in the "Energy Prices and Discount Factors for Life-Cycle Cost Analysis 1994" as compiled by the

Minutes of Meeting

Subject	Decision/Action Summary
	National Institute of Standards and Technology for the United States Department of Energy. This same standard recommends that a 4.0% discount factor be used for study periods of up to 10 years. The ECIP guidelines utilize a discount rate of 4.0 % to establish the energy price escalation factors. The COE must advise EYP as to the actual discount rate which is to be applied to this study. Please note that the life cycle cost analysis software packages allow the user to input any discount factor.
	7. EYP will comply. The COE will provide a copy of this standard to EYP.
	8. As stated in the report this system is best utilized for residential and small commercial systems as it is currently being applied, and does not have application for the buildings in this study. EYP will expand on the narrative that describes the abilities and limitations of this system.
	9. COE will clarify this comment. To what guide specification does it refer.
	10. The input data will be reviewed to confirm validity. If any errors are found they will be corrected, otherwise the data will be utilized. COE will advise as to the range that would normally be expected.
	11. The manufacturers of the DDC systems have indicated that fiber optics can be utilized as a communications path for the control systems. COE will advise if there is additional guidance referred to in this comment.
	12. This study will recommend a type of EMS to be installed in each building, it will not specify each individual control point; therefore, whether the existing boiler remains or is replaced will have little effect on the outcome of this recommendation.

Minutes of Meeting

Subject	Decision/Action Summary
	13. These chillers use R-22. This will be stated in the Pre-final submittal of the report.
	14. This statement is true; however, this study will recommend a type of EMS to be installed in each building, it will not specify each individual control point; therefore, whether the existing chiller remains or is replaced will have little effect on the outcome of this recommendation.
	15. This chiller uses R-22. This will be stated in the Pre-final submission of the report.
	16. This chiller uses R-22. This will be stated in the Pre-final submission of the report.
	17. Where available, lighting wattage values were taken from the original construction drawings and verified in the field. Also please note that building 200 is a recreation building with special areas which contain considerable amounts of incandescent lighting. The input data will be verified and corrected if found to be in error.
	18. The 25 sq ft per person is for an assembly area and will be verified prior to the Pre-final submission of the report.
	19. EYP will establish an estimated infiltration rate based on building conditions and utilize this rate consistently for the baseline conditions as well as all ECO alternatives.
	20. ECIP Summary sheets will be included in the Pre-final submission of the report.
	21. See the enclosed letter explaining the BLCC program.
	22. All input information for the energy modeling was included in Appendix C of the report. If further information is need please specify.
	23. See the enclosed letter explaining the BLCC program.

Minutes of Meeting

Subject	Decision/Action Summary
	24. See the attached letter explaining the BLCC program. COE is to provide a copy of TM 5-802-1.
Review of the Post's Comments:	EYP Response
	1. All spelling errors will be corrected prior to the Pre-final submittal.
	2. EYP will explain in more detail the capabilities and limitations of the existing FM Switch system in the Pre-Final submittal.
	3. Schematic diagrams and drawings are being formulated and will be included in the Pre-Final submittal.
	4. The advantages and disadvantages of each type of EMS will be described in more detail in the Pre-Final submittal.
	5. The purpose of the study will be more clearly stated in the Pre-Final submittal. The Executive Summary will also include a recommended strategy for applying EMS to each of the sample buildings.
	6. A matrix is being developed to evaluate the relative merits of all three system types. This matrix will be completed and included in the Pre-Final submittal.
	7. A simple electric rate of $0.0616/Kwh will be used for all energy cost calculations as determined by the Installation Utility Chief.
	8. EYP will use data that was shown on the original contract drawings for each building. Where such data is not available EYP will estimate the outside air quantities based on known conditions.
	9. Proposed systems have not yet been finalized and will be described in more detail in the Pre-Final submittal.

Subject	Decision/Action Summary
	10. All conclusions will be supported by cost/benefit data in the Pre-Final submittal.
	11. The cost of the equipment necessary to connect the building EMS to the post fiber optic system as well as the cost of the central terminal and related software outweigh the benefit if only a small number of buildings are connected to the system. A more descriptive narrative with actual cost data will be included in the Pre-Final submittal.
	12. The general Ft. Belvoir data, as provided by Mike Stumbaugh will be included in the Pre-Final submittal.
	13. All energy savings data is generated by a computer program which is based on equipment input information and does not reflect items such as demand savings and system maintenance costs. EYP will investigate modifying the program input data to more closely simulate the differences in energy costs between the PLC and DDC systems.
	14. EYP will describe the limitations of the computer simulation program and how the program was used to model the energy usage for the baseline conditions as well as all ECO alternatives.
	15. The Pre-final report will include a section which describes what factors will most likely effect the energy usage in a given building and how this affects the savings potential of an EMS.
Re-Submittal	The Interim Report will be revised and re-submitted, for record purposes, within four weeks after EYP receives all information which is to be provided by COE and Ft. Belvoir.
	The Pre-final Report will be submitted for review within 45 days after EYP receives all information which is to be provided by COE and Ft. Belvoir.

Minutes of Meeting

Project Name:	Ft. Belvoir EMS Study
Project Number:	60692.00
Date of Meeting:	11/22/94
Time of Meeting:	10:30 a.m.
Location of Meeting:	Ft. Belvoir Building 1442
Meeting Number:	4

To:
Mr. James Hawk
CENAB AE Acquisition Branch
10 S. Howard Street
Baltimore, MD 21201
COE Project No. DACA31-92-D-0061
Delivery Order No. 0004

Purpose of Meeting:

To review comments on Pre Final submittal.

Attendees:	Representing:
Jim Hawk	COE
Mike Stumbaugh	DPW - Fort Belvoir
David Smith	Einhorn Yaffee Prescott
Julius Stone	Einhorn Yaffee Prescott

The following constitutes my understanding of the items discussed and the decisions reached. If there are any additions or corrections, please contact the undersigned:

cc: Attendees

Signed: ____________________

Date: ____________________

Minutes of Meeting

Subject	Decision/Action Summary
Review of Comments	Agreed Upon Course of Action: Purnell's Comments: 1. EYP will provide tabs and dividers and add page numbers to the appendices. 2. A typographical error was found in this calculation and the will be corrected in the revised submission. 3. The Washington, DC weather data was compared to the actual Ft. Belvoir data and it was determined that the average difference in the mean monthly temperature was less than one degree fahrenheit. It was agreed that the Washington DC data was valid and would be accepted by the COE and Ft. Belvoir. Stumbaugh's Comments: 1. EYP will include page number references in the Table of Contents. 2. EYP will replace the Installation Mission with a statement provided by Mike Stumbaugh and will change the term 'base' to 'installation' throughout the revised report. 3. All references to FM Switch (FMS) will be changed to FM Relay (FMR) throughout the revised report. The demand savings will be estimated using a calculation which is based on the demand savings strategy described in Section 2 of the report. 4. EYP will describe in the revised report, the probable reasons that building 3136 did not qualify for ECIP funding while building 1425 did and they are of similar construction and system type. 5. EYP will develop further criteria for applying the results of this study to other buildings on the installation. This criteria will be explained in the Executive Summary of the revised report using tables or charts wherever possible.

Subject	Decision/Action Summary
	6. EYP will revise the term 'control information' in the second paragraph in Methodology to read 'type and condition of existing control systems'. The Washington DC weather data will be utilized and is acceptable to COE and Ft. Belvoir. 7. EYP will describe in the Methodology section of the revised report the relative values of the features listed in the EMS Evaluation Matrix. 8. The label AHU-1 refers to a type of unit. The drawings will remain as originally submitted. Hawk's Comments: 1. The reference to the incorrect format refers mainly to the Executive Summary of the report. More specific statements are made in comment 2. 2. The format of the executive summary as follows. a: Table 1 will be modified to exclude the ECIP compliance column and include a column for Total KBTU savings. This table will also serve as the list of ECOs considered. b: EYP will include specific recommendations concerning the future of the existing FMR system. e: EYP will create a table comparing the energy savings, economic and operational merits of all three systems for each building. Following this table will be specific recommendations for each building based on the content of the table. f: EYP will include specific recommendations concerning the future of the existing FMR system. g: Becuase the main purpose of this report is to establish criteria for installation wide implementation of EMS

Minutes of Meeting

Subject	Decision/Action Summary
	each ECO will be treated as an individual project. Table 1 will serve as the summary of the ECO packaging. h: None of the ECOs evaluated will qualify for ECIP funding because the cost estimates are less than $300,000. Mike Stumbaugh indicated that other funding programs would be used. Based on this information EYP will include Life Cycle Cost Analysis Summary sheets for each recommended ECO. These summary sheets will serve as the appropriate programming documentation. i: EYP will include Life Cycle Cost Analysis Summary Sheets for each recommended ECOs. j: EYP will develop further criteria for applying the results of this study to other buildings on the installation.
Electric Rate	The Ft. Belvoir Utility Chief has established an equivalent electric rate of $0.0616 /kw hr. This rate includes all demand and administrative charges in addition to the electrical consumption charges. It was previously agreed that this value would be used in all energy calculations. Subsequent to the submission of the Pre Final report it was determined that demand savings calculations could be included in the study in addition to energy consumption estimates. It was agreed that the equivalent rate was no longer valid because it includes the demand costs which were also being estimated in the demand savings calculations. Based on this information it was decided that the actual billing rate of $0.01968/kw hr would be used for estimating electrical consumption costs.
Resubmission	EYP will resubmit the Pre Final report on January 18, 1995. EYP will deliver one copy of the report to each of the following agencies: 1. Mr. James Hawk CENAB, AE Acquisition Branch City Crescent Building 10 S. Howard Street Baltimore, Maryland 21201

Minutes of Meeting

Subject	Decision/Action Summary
	2. USA Garrison - Ft. Belvoir Attention Mike Stumbaugh 9430 Jackson Loop, Suite 107 Ft. Belvoir, Virginia 22060 3. U.S. Army Corps of Engineers Mobile, Alabama (Mr. Hawk is to provide the complete address for this agency) All copies of the report will be in three-ring binders.
Payment	Mr. James Hawk will process payment of an EYP invoice for 65% of the total contract amount for work completed to date.

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MD 21203-1715

REPLY TO
ATTENTION OF

December 29, 1994

Engineering Division

Mr. David Smith
Project Manager
Einhorn, Yaffee Prescott
1000 Potomac Street, N.W.
Washington, DC 20007-3238

Dear Mr. Smith:

Reference is made to the minutes of the Prefinal Review Meeting held at Fort Belvoir, Virginia, December 6, 1994, for the Fort Belvoir Family Housing Insulation (encl 1), and EMS Study (encl 2), Contract DACA31-92D-0061, submitted to Mr. James Hawk for review.

The minutes submitted on December 5, 1994 have been reviewed and are accepted. If you have any questions, please contact Mr. James Hawk at 410-962-6704.

Sincerely,

Stanley N. Block, P.E.
Chief, Military Branch

Encls

Minutes of Meeting

Project Name:	Ft. Belvoir EMS Study
Project Number:	60692.00
Date of Meeting:	6-1-95
TimeOof Meeting:	10:30 a.m.
Location of Meeting:	Ft. Belvoir Building 1442
Meeting Number:	5

To:
Mr. James Hawk
CENAB AE Acquisition Branch
10 S. Howard Street
Baltimore, MD 21201
COE Project No. DACA31-92-D-0061
Delivery Order No. 0004

Purpose of Meeting:

To review comments on revised Pre-Final submission.

Attendees:	Representing:
Jim Hawk	COE - Baltimore District
Wayne Stone	DPW - Ft. Belvoir
John Strang	DPW - Ft. Belvoir
David Smith	Einhorn Yaffee Prescott
Julius Stone	Einhorn Yaffee Prescott

The following constitutes my understanding of the items discussed and the decisions reached. If there are any additions or corrections, please contact the undersigned:

cc: Attendees
Tony Battaglia, COE - Mobile District

Signed: ____________________

Date: ____________________

Minutes of Meeting

Subject	Decision/Action Summary
	The following are our responses to the Prefinal review comments for this project:
Comments From Stumbaugh Comment No.1:	1. A "Purpose" section should precede the Executive Summary. The purpose section found on Page II-1 would be appropriate. 2. There appears to be seven mission elements. 3. The third paragraph should be removed. 4. Throughout the text, "Installation" should be capitalized when referring to Fort Belvoir. 5. Executive Order 12902. 6. FY should be placed in front of 1985 and 2005.
EYP Response:	The Purpose section from Page II-1 will be copied and inserted into the Introduction section of the Executive Summary. The third paragraph of the Executive Summary will be removed. The term "Installation" will be capitalized throughout the report. The Executive Order will be referred to as Executive Order 12902. FY will be placed in front of 1985 and 2005.
Comment No. 2:	The * appears unnecessary. If Building 1425 is to come under true DDC, then the vendor will still have to replace almost all of the existing components, with the exception of the wiring. There will still be a significant cost for the central building controller and associated compatible components. A DDC for 1425 may not be as expensive as starting from scratch, but it would still be a real cost and a valid project to connect 1425 to the central system.
EYP Response:	The * is necessary because the savings and payback estimates are based on a baseline condition with no time of day scheduling control. Building 1425 is currently equipped with a control system capable of time of day scheduling.
Comment No. 3:	In some cases, real energy savings could be achieved with FMR. The AC for a small building with a significant unoccupied period could simply be turned off at night in the summer and shoulder months. The problem generally is lack of feedback. Full pump-down would have to be incorporated in the FMR to safeguard the system.

Subject	Decision/Action Summary
EYP Response:	Buildings with extended unoccupied periods could be effectively controlled using the FMS. This is only recommended for buildings with a set schedule or where operating personnel can be notified in advance of changes in the occupancy schedule. This information will be included in the Executive Summary.
Comment No. 4: √	1. There should be an FY in front of 1985 and 2000. 2. The following sentence should be changed: "For this reason the control system reliability will be significantly increased for two reasons."
EYP Response:	FY will be added in front of 1985 and 2000. "for two reasons" will be changed to "in two ways."
Comment No.5: √	1. Building 3136 analysis: do you have the costs associated with fixing the system and installing a DDC at the same time? Would this project meet ECIP criteria? 2. Under ECIP projects developed, present simple payback and installed cost along with SIR. 3. The last sentence on the page should start with "Another" instead of "Other".
EYP Response:	The economic analysis of repair/replacement of the existing HVAC system is beyond the Scope of Work for this project. The sentence will be changed to begin with "another" in lieu of "other".
Comment No. 6: √	Remember to capitalize "Installation" throughout the document.
EYP Response:	"Installation" will be capitalized throughout the report.
Comment No. 7: √	1. Arrowheads should be placed on all the path lines. 2. Ensure that all the interrogatives end in question marks. 3. Is there any way to work in building size and/or consumption as an initial criteria on this flowchart (e.g., Is the building > 10,000 sf and have an annual heating consumption > 1,000 gallons?)
EYP Response:	Arrowheads will be added and, all interrogatives will be changed to end in a question mark. No relationship between building size or consumption and payback could be found in the extrapolation of data from this study.

Minutes of Meeting

Subject	Decision/Action Summary
Comment No. 8:	1. Simple payback should be recorded to one decimal place. 2. "Total Energy Savings KBTU" should be "Total Annual Energy Savings KBTU".
EYP Response:	Simple payback will be recorded to one decimal place. The "Total Energy Savings KBTU" column head will be changed to read "Total Annual Energy Savings".
Comment No. 9:	1. Check (BOD Oct 1994) - What does BOD stand for? 2. Check the 2.I. line and ensure that the MBTU/Yr. Savings is totaled. 3. check these items for each ECIP form.
EYP Response:	BOD is a typographical error. The line should read October 1994. The line 2.I. will be checked for all ECIP sheets and changes will be made where necessary.
Comments From Battaglia/Woodruff:	
Comment No. 1: (General)	When tables are referenced in the text of the study the location of the table should be given. An example of this is on Page 1-6 of the Executive Summary in the last paragraph.
EYP Response:	All references to tables will be changed to include the page number of the table referenced.
Comment No. 2: (General)	The study contains numerous instances where words have been deleted or added to the text. Some examples of this are: Page 1-5, Paragraph 4, line three, the word "in" should be inserted between the words actuators and each. On Page 1-7 in the last line of the first complete paragraph, the work "must" has been added.
EYP Response:	The report will be reviewed for words deleted or added to the text and corrections will be made where necessary.
Comment No. 3: (Ex. Sum. P. I-6)	The text of the first complete paragraph of this page describes what would be a good FEMP project.

Minutes of Meeting

Subject	Decision/Action Summary
EYP Response:	This may indeed qualify for FEMP funding; however economic analysis of this type of mechanical upgrade and/or replacement is beyond the scope of this study.
Comment No.4: (Ex. Sum. P. I-9)	The first sentence on this page presents an impossibility. If the systems do not have a payback they cannot be recommended.
EYP Response:	A stated goal of this project was to recommend control strategies to be applied to the entire installation. For this reason, conclusions where derived using subjective as well as objective economic analysis. While it is true that the recommended system does not provide a payback for this building, it does add significantly to the energy and total economic savings installation-wide. The FMR system will be described as the best economic alternative.
Comment No. 5: (Ex. Sum. P. I-18)	Under investment cost 5.5% should be shown for SIOH and 6% should be used for the design cost. This applies to the other economic calculations as well.
EYP Response:	Design costs and SIOH will be added as instructed.
Comment No. 6: (Ex. Sum. P. I-18)	The ECIP Guidance requires a discount rate of 3.1% for the demand savings discount factor.
EYP Response:	As stated in a previous review comment response, the FEMP or ECIP discounted factor is listed as 3.1% in the "Energy Prices and Discount Factors for Life-Cycle Cost Analysis 1994" as compiled by the National Institute of Standards and Technology for the United States Department of Energy. This same standard recommends that a 4.0% discount factor be used for study periods up to 10 years. The ECIP Guidelines utilize a discount factor of 4.0% to establish the energy price escalation factors. The COE must advise EYP as to the actual discount rate which is to be applied to this study. 3.1% AS PER JIM HAWK/TONY BATTAGLIA
Comment No. 7: (General)	LCCA summary sheets should be provided for each alternative evaluated.

Subject	Decision/Action Summary
EYP Response:	Section 7.6.2 of the Scope of Work for this project requires that LCCA Summary Sheets be provided for all recommended projects. The LCCA output sheets are provided for all investigated ECOS in Section III of the report.
Comment No. 8: (Vol. 1, P. II-4)	In regard to the Energy Management System Evaluation Matrix, there should be some backup calculations to support the assigned values, or this approach should be abandoned in favor of one that evaluates each of the application programs for each of the building investigated.
EYP Response:	The assigned values for this matrix are explained in Section II of the report. It is meant to compare in a relative analysis, the different capabilities of the system being studied. The matrix was developed in conjunction with Ft. Belvoir personnel and was modified over the course of this study to satisfy their requirement to quantify some of the subjective advantages of these three very different systems. The matrix is only one of the tools used to evaluate the systems.
Comment No. 9: (Vol. 1, P. II-5)	The figure referenced in the second paragraph should be 2.2 not 2.1. Figure 2.2 on the following page is not dark enough.
EYP Response:	The reference to Figure 2.1 on Page II-5 will be changed to Figure 2.2. Figure 2.2 will be darkened so that it is readable.
Comment No. 10: (Vol. 1, P. II-10)	The whole description of Direct Digital Control EMS systems is superficial. TM5-815-2 requirements should be discussed.
EYP Response:	The Scope of Work Appendix A, Section B requires a description of products and systems. Section II.C provides a description of the systems studied, in order to give the reader a simplified understanding of the functions and capabilities of each system. The DDC system description provides the reader with an overview of the systems available in the marketplace today.
Comment No. 11: (Vol. 1, P. III-1)	Are the values at the bottom of this page measured or nameplate values?

Subject	Decision/Action Summary
EYP Response:	The values used in all demand savings calculations are nameplate data collected and shown on the equipment data sheet. All ampere ratings are full load values.
Comment No. 12: √ (Vol. 1, P. III-2)	The Power Factor used in this calculation looks low. Is there some backup data to show where it came from?
EYP Response:	The power factor value utilized in the demand savings calculations was an assumption based on a comparison of catalog data for similar model air cooled packaged chillers. Catalog data will be included in the Appendix along with calculation.
Comment No. 13: √ (Vol. 1, P. III-4)	The list on this page lists the points but not the applications. The applications should be listed and must agree with the HAP in Appendix C.
EYP Response:	The application of the controllers in the proposed system is described in the text preceding the point lists. This application data and the points list match the system modeled in the HAP which is described in Appendix C. This point will be explained in the methodology section of the report.
Comment No. 14: √ (Vol. 1, P. III-9)	The Discount rate should be 3.1% not 4.0%.
EYP Response:	See Comment 6 response.
Comment No. 15: √ (Vol. 1, P. III-9)	Demand is being treated as an energy expenditure which would use one type of PW discount factor. However demand should be treated as an annually recurring non-energy savings, which uses a different type of PW discount factor.
EYP Response:	"Building Life Cycle Cost" BLCC 4.0 from NIST was used for all LCCA calculations. The demand costs were entered in the appropriate field and the program automatically applies the correct discount rate for each type of expense. See Appendix E for program inputs. The Life Cycle Cost Analysis Summary Sheets in Section I for the recommended projects use the discount rates specified in the ECIP criteria.

Subject	Decision/Action Summary
Comment No. 16: √ (Vol. 1, P. III-24)	What appears to be missing is the calculations that show how the values shown in this table were obtained. We know that the Carrier HAP Program was used to do the calculations about how did the input for this case vary from that of the base case in order to account for all of the applications? This comment is applicable to all of the ECO Building Simulation Results.
EYP Response:	The Input Data for the Carrier E20-II Program is shown in Appendix C and reflects the applications of the different systems described for each in Section II for each analysis.
Comment No. 17: √ (Vol. 1, P. III-24)	The top paragraph on this page tries to justify DDC even though DDC has no SIR
EYP Response:	Refer to Comment 4 response.
Comment No. 18: √ (Vol. 1, P. C-4)	The lighting operating schedule does not look realistic. There realistically would not be 100% lighting for 12 hours on Saturday and 10 hours on Sunday.
EYP Response:	Building 200 is a recreation facility, the hours for the lighting and people occupancy reflect the posted hours of operation for this facility.
Comment No. 19 √ (Vol. 1, P. C-40)	Why are you allowing cooling and heating overlap? Is this the reason for higher annual cooling loads shown on Page D-5? √
EYP Response:	This building utilizes a four pipe system which will allow for simultaneous operation of the heating and cooling systems. The input is correct for the PLC and DDC models. It is incorrect however for the base building model. The base building model will be corrected and the calculations will be performed again.
Comment No. 20: √ (Vol. 1, P. C-52)	Is the heating and cooling overlap shown in this schedule the reason for the annual cooling coil load on Page D-7 being greater than for the base case shown on Page D-3? √
EYP Response:	See Comment 19 response.

Subject	Decision/Action Summary
Comment No. 21: (Vol. 1, P. C-80)	Explain why part-load efficiency is the same as full load capacity.
EYP Response:	The burner on this boiler has a single fixed firing rate. For this reason the part load efficiency "equals" the full load efficiency. The inputs for the other ECOs will be checked and corrected as necessary to reflect this condition.
Comment No. 22: (Vol. 1, P. C-82)	The part-load performance data in this table looks more realistic than that shown for the base case. What effect would PLC have on the boiler efficiency at part load.
EYP Response:	See Comment 21 response.
Comment No. 23: (Vol. 1, P. G-7)	Why are there two Honeywell price quotes for Building 200?
EYP Response:	The third price quote is actually from Andover; this typographical error will be corrected. It will have no effect on the results of the study.
Acceptance of Submission:	Mr. Hawk stated that the Pre-Final Submission was accepted as noted.
Payment:	Mr. Smith is to submit an invoice for 90% and Mr. Hawk will process this invoice for payment.
Final Submission:	COE is to provide information concerning discount factors and all revisions will be made as described above. Wayne Stone and John Strang from Ft. Belvoir are to provide copies of the programming documentation necessary for funding. After receipt of this information, EYP will complete the Final Submission and submit it to COE. N:\60692.00\MINUTES\95-5-F16.WPD

APPENDIX K
MISCELLANEOUS CALCULATIONS

SAMPLE CALCULATION TO ESTABLISH APPROXIMATE POWER FACTOR FOR AIR COOLED RECIPROCATING CHILLERS.

CATALOG DATA FOR SIMILAR CHILLER INDICATES THE FOLLOWING

- FULL LOAD AMPACITY FOR 40 TON CHILLER (PAGE K-2)

4 COMPRESSORS @ 17.2 AMP EACH = 68.8
\+ 4 FANS @ 1.8 AMP EACH = 7.2
76 AMPS

FLA = 76 AMPS @ 460 V 3ϕ

- KW INPUT @ FULL LOAD & 95°F ENTERING AIR (PAGE K-3)

KW = 39.6

$$\text{POWER FACTOR (@ FULL LOAD)} = \frac{W}{(V)(A)(\sqrt{3})} \quad \text{FOR THREE PHASE POWER}$$

$$= \frac{39{,}600\,W}{(460)(76)(\sqrt{3})}$$

$$\boxed{PF = 0.65}$$

THIS POWER FACTOR VALUE IS USED FOR ALL DEMAND SAVINGS CALCULATIONS THROUGHOUT THE REPORT.

Electrical Data

10-60 Tons

Table 31-1 — Electrical Data

		Unit Wiring					Motor Data						
	Model	Nameplate	Voltage		Max Fuse	Rec. Dual	Compressor (Ea)			Fans (Ea)			Control
Tons	Number	Voltage	Range	MCA	Size	Element	Qty	RLA	LRA	Qty	KW	FLA	KW
10	CGA120B1	208-230/60/1	187-254	71.0	90		2	28.9	150	1	.95	6	—
	CGA120B3	208-230/60/3	187-254	48.3	60		2	18.8	118	1	.95	6	—
	CGA120B4	460/60/3	414-506	25.2	35		2	10.0	71	1	.95	2.7	—
	CGA120BW	575/60/3	518-632	17.3	20		2	6.8	43	1	.95	2.0	—
15	CGA180B3	208-230/60/3	187-254	72.6	90		2	29.5	179	2	1.03	3.1	—
	CGA180B4	460/60/3	414-506	33.6	40		2	13.5	90	2	1.03	1.6	—
	CGA180BW	575/60/3	518-632	26.7	35		2	10.8	72	2	1.03	1.2	—
20	CGAD-C20	200-230/60/3	180-220	97	125	110	2	39.4	247	2	0.9	4.1	0.2
		200-230/60/3	208-254	97	125	110	2	39.4	247	2	0.9	4.1	0.2
		460/60/3	416-508	43	60	50	2	17.2	95	2	0.9	1.8	0.2
		575/60/3	520-635	33	45	40	2	13.2	76	2	0.9	1.4	0.2
25	CGAD-C25	200-230/60/3	180-220	122	175	150	2	39.4,56.0	247,376	3	0.9	4.1	0.2
		200-230/60/3	208-254	122	175	150	2	39.4,56.0	247,376	3	0.9	4.1	0.2
		460/60/3	416-508	52	70	60	2	17.2,23.5	95,142	3	0.9	1.8	0.2
		575/60/3	520-635	41	50	45	2	13.2,18.7	76,114	3	0.9	1.4	0.2
30	CGAD-C30	200-230/60/3	180-220	139	175	175	2	56.0	376	3	0.9	4.1	0.2
		200-230/60/3	208-254	139	175	175	2	56.0	376	3	0.9	4.1	0.2
		460/60/3	416-508	59	80	70	2	23.5	142	3	0.9	1.8	0.2
		575/60/3	520-635	47	60	60	2	18.7	114	3	0.9	1.4	0.2
40	CGAD-C40	200-230/60/3	180-220	184	200	200	4	39.4	247	4	0.9	4.1	0.3
		200-230/60/3	208-254	184	200	200	4	39.4	247	4	0.9	4.1	0.3
		460/60/3	416-508	81.	90	90	4	17.2	95	4	0.9	1.8	0.3
		575/60/3	520-635	62	70	70	4	13.2	76	4	0.9	1.4	0.3
50	CGAD-C50	200-230/60/3	180-220	230	250	250	4	39.4,56.0	247,376	6	0.9	4.1	0.3
		200-230/60/3	208-254	230	250	250	4	39.4,56.0	247,376	6	0.9	4.1	0.3
		460/60/3	416-508	99	110	110	4	17.2,23.5	95,142	6	0.9	1.8	0.3
		575/60/3	520-635	77	90	90	4	13.2,18.7	76,114	6	0.9	1.4	0.3
60	CGAD-C60	200-230/60/3	180-220	263	300	300	4	56.0	376	6	0.9	4.1	0.3
		200-230/60/3	208-254	263	300	300	4	56.0	376	6	0.9	4.1	0.3
		460/60/3	416-508	111	125	125	4	23.5	142	6	0.9	1.8	0.3
		575/60/3	520-635	88	100	100	4	18.7	114	6	0.9	1.4	0.3

Notes:

1. MCA: Minimum Circuit Ampacity is 125 percent of the largest compressor RLA plus 100 percent of the other compressor(s) RLA plus the sum of the condenser fan FLA per NEC 440-33.
2. Maximum Fuse Size: 225 percent of the largest compressor RLA plus 100 percent of the other compressor(s) RLA plus the sum of the condenser fan FLA per NEC 440-22.
3. Recommended Dual Element Fuse Size: 150 percent of the largest compressor RLA plus 100 percent of the other compressor(s) RLA plus the sum of the condenser fan FLA.
4. RLA: Rated in accordance with UL standard 465.
5. Local codes may take precedence.
6. Control kw includes operational controls only. Does not include evaporator heat tape.
7. All units are across the line starting. Compressors will never start simultaneously.
8. One 115/60/1, 15 amp. jobsite provided power connection is required to operate both the unit controls and evaporator heat tape. If the optional control power transformer is ordered, one jobsite supplied 115/60/1, 15 amp. power connection is required for the evaporator heat tape. All CGA 120 and 180 units have 24-volt control power transformer provided as standard.
9. All 200/230 volt units are factory set for 200 volt usage. For 230 volt usage, wiring leads on the unit transformers must be changed at the jobsite. All CGA 120 and 180 units are factory set for 230-volt usage, wiring leads on unit transformers must be changed at the job site.

K-2

Performance Data

10-80 Tons Part Load

Table 29-1 — Part Load Data, ARI Points (10-80 Tons)

			Entering Condenser Air Temperature (Degrees F)							
Tons	Model Number		95 100% Load	87 80% Load	85 75% Load	79 60% Load	75 50% Load	71 40% Load	67 30% Load	65 25% Load
		EER	9.5	—	—	—	11.6	—	—	—
10	CGA 120	Capacity (Tons)	8.8	—	—	—	4.8	—	—	—
		KW Input	10.1	—	—	—	4.0	—	—	—
		EER	9.6	—	—	—	11.1	—	—	—
15	CGA 180	Capacity (Tons)	14.4	—	—	—	7.6	—	—	—
		KW Input	17.0	—	—	—	7.1	—	—	—
		EER	9.7	—	—	—	13.9	—	—	—
20	CGAD-C20	Capacity (Tons)	18.0	—	—	—	10.8	—	—	—
		KW Input	20.0	—	—	—	7.1	—	—	—
		EER	9.3	—	—	12.5	—	13.7	—	—
25	CGAD-C25	Capacity (Tons)	22.4	—	—	15.3	—	11.2	—	—
		KW Input	25.8	—	—	11.6	—	6.7	—	—
		EER	9.7	—	—	—	14.0	—	—	—
30	CGAD-C30	Capacity (Tons)	27.1	—	—	—	16.0	—	—	—
		KW Input	30.4	—	—	—	10.6	—	—	—
		EER	9.7	—	11.2	—	14.1	—	—	15.0
40	CGAD-C40	Capacity (Tons)	35.2	—	28.1	—	21.4	—	—	10.9
		KW Input	39.6	—	25.4	—	14.0	—	—	6.4
		EER	9.3	10.8	—	12.6	—	—	14.0	—
80	CGAD-C50	Capacity (Tons)	44.4	37.8	—	30.6	—	—	15.7	—
		KW Input	51.6	35.4	—	23.2	—	—	10.2	—
		EER	9.5	—	11.1	—	14.1	—	—	15.2
60	CGAD-C60	Capacity (Tons)	52.7	—	41.8	—	31.9	—	—	16.3
		KW Input	60.8	—	39.0	—	21.2	—	—	9.6
		EER	9.9	—	10.5	—	11.8	—	—	13.4
70	CGAC-C70	Capacity (Tons)	62.5	—	50.8	—	34.3	—	—	21.6
		KW Input	70.0	—	52.6	—	31.8	—	—	16.4
		EER	9.7	—	10.6	—	12.1	—	—	13.3
80	CGAC-C80	Capacity (Tons)	73.9	—	62.0	—	40.7	—	—	25.1
		KW Input	83.4	—	61.6	—	36.2	—	—	18.3

Notes:
1. Table 29-1 data is rated in accordance with ARI Standard 590-81, Section 7.3.
   — 44 F leaving chilled water temperature.
   — (55 F + 0.4 F x % Load) = entering ambient temperature.
   — Constant evaporator waterflow as determined at full load operation at 95 F ambient and 10 F evaporator temperature drop.
   — % Load by compressor displacement as defined by ARI Standard 590-81.
2. Kw input is for compressors only.
3. EER = Energy Efficiency Ratio, (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.

Einhorn Yaffee Prescott
ARCHITECTURE & ENGINEERING, PC

Project Name E[illegible] Project No. 60692.00
Calculated by DLS Date 8/16/95
Checked by Date
Scale Sheet No. of

TOTAL ENERGY CALCULATIONS BY ENERGY TYPE

BLDG 200 - BASE & FMR (FROM PAGE D-2)

ELECTRIC - HVAC
291599 kWh
14580 (5% SEE PAGE II-2)
306179 KWh

ELECTRIC - NON-HVAC
421743 kWh
$\boxed{727922 \text{ kWh}}$

NATURAL GAS
28480 Therm
+ 1424 (5% - SEE PAGE II-2)
$\boxed{29904 \text{ Therm}}$

BLDG 200 - PLC (FROM PAGE D-4)

ELECTRIC - HVAC
233536 kWh
11677 (5% SEE PAGE II-2)
245213
421743 KWh
$\boxed{666956 \text{ kWh}}$

NATURAL GAS
21115 Therm
+ 1056 (5% - SEE PAGE II-2)
$\boxed{22171 \text{ Therm}}$

BLDG 200 - DDC (FROM PAGE D-6)

ELECTRIC - HVAC 206634 kWh
ELECTRIC - NON-HVAC 421743 kWh
$\boxed{628377 \text{ kWh}}$

NATURAL GAS $\boxed{18411 \text{ Therm}}$

Einhorn Yaffee Prescott
ARCHITECTURE & ENGINEERING PC

Project Name FT BELVOIR EMS STUDY Project No 60692.00
Calculated by DLS Date 8/16/95
Checked by Date
Scale Sheet No. of

TOTAL ENERGY CALCULATIONS BY ENERGY TYPE

BLDG 219 BASE & FMR (FROM PAGE D-9)

ELECTRIC - HVAC	388008 kWh
	19400 (5% SEE PAGE II-2)
	407408 kWh
ELECTRIC - NON HVAC	496200 kWh
	$\boxed{903608 \text{ kWh}}$
NATURAL GAS	23850 Therm
	+ 1193 (5% SEE PAGE II-2)
	$\boxed{25043 \text{ Therm}}$

BLDG 219 PLC (FROM PAGE D-11)

ELECTRIC - HVAC	190811 kWh
	9541 (5% SEE PAGE II-2)
	200351 kWh
ELECTRIC - NON HVAC	496200 kWh
	$\boxed{696551 \text{ kWh}}$
NATURAL GAS	15490 Therm
	775 (5% SEE PAGE II-2)
	$\boxed{16265 \text{ Therm}}$

BLDG 219 DDC (FROM PAGE D-13)

ELECTRIC - HVAC	181447 kWh
ELECTRIC - NON HVAC	496200 kWh
	$\boxed{677647 \text{ kWh}}$
NATURAL GAS	$\boxed{15490 \text{ Therm}}$

Einhorn Yaffee Prescott
ARCHITECTURE & ENGINEERING PC

Project Name FT BELVOIR EMS STUDY   Job No. 3692.00
Calculated by PLS   Date 8/16/95
Checked by   Date
Scale   Sheet No.   of

TOTAL ENERGY CALCULATIONS BY ENERGY TYPE

BLDG 247 BASE & FMR   (FROM PAGE D-16)

ELECTRIC - HVAC   592897 kWh
29645 (5% SEE PAGE II-2)
622542 kWh

ELECTRIC - NON HVAC   1422880 kWh
$\boxed{2045422 \text{ kWh}}$

NATURAL GAS   38163 Therm
1908 (5% SEE PAGE II-2)
$\boxed{40071 \text{ Therm}}$

BLDG 247 PLC   (FROM PAGE D-18)

ELECTRIC - HVAC   406978 kWh
20349 (5% SEE PAGE II-2)
427327 kWh

ELECTRIC - NON HVAC   1422880 kWh
$\boxed{1850207 \text{ kWh}}$

NATURAL GAS   27010 Therm
1351 (5% SEE PAGE II-2)
$\boxed{28361 \text{ Therm}}$

BLDG 247 DDC   (FROM PAGE D-20)

ELECTRIC HVAC   404356 kWh
ELECTRIC NON HVAC   1422880 kWh
$\boxed{1827236 \text{ kWh}}$

NATURAL GAS $\boxed{27079 \text{ Therm}}$

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TOTAL ENERGY CALCULATIONS BY ENERGY TYPE

BLDG 1425 BASE & FMR (FROM PAGE D-23)

ELECTRIC - HVAC	72273 KWh
	3614 (5% SEE PAGE II-2)
	75887 KWh
ELECTRIC - NON HVAC	189882 KWh
	$\boxed{265769 \text{ KWh}}$
DISTRICT STEAM	242,000 lb
	12,100 (5% SEE PAGE II-2)
	$\boxed{254,100 \text{ lb}}$

BLDG 1425 PLC (FROM PAGE D-25)

ELECTRIC - HVAC	56679 KWh
	2834 (5% SEE PAGE II-2)
	59513 KWh
ELECTRIC - NON HVAC	189882 KWh
	$\boxed{249395 \text{ KWh}}$
DISTRICT STEAM	70000 lb
	3500 (5% SEE PAGE II-2)
	$\boxed{73500 \text{ lb}}$

BLDG 1425 DDC (FROM PAGE D-27)

ELECTRIC - HVAC	56679 KWh
ELECTRIC NON HVAC	189882 KWh
	$\boxed{246561 \text{ KWh}}$
DISTRICT STEAM	$\boxed{70000 \text{ lb}}$

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TOTAL ENERGY CALCULATIONS BY ENERGY TYPE

BLDG 3136 BASE & FMR (FROM PAGE D-30)

ELECTRIC - HVAC
82975 kWh
4149 (5% SEE PAGE II-2)
87124 kWh

ELECTRIC - NO HVAC
256487 kWh
$\boxed{346101 \text{ kWh}}$

DISTRICT STEAM
413,000 lb
20650 (5% SEE PAGE II-2)
$\boxed{433650 \text{ lb}}$

BLDG 3136 PLC (FROM PAGE D-32)

ELECTRIC - HVAC
75724 kWh
3786 (5% SEE PAGE II-2)
79510 kWh

ELECTRIC - NON-HVAC
256487 kWh
$\boxed{335997 \text{ kWh}}$

DISTRICT STEAM
228,000 lb
11400 (5% SEE PAGE II-2)
$\boxed{239400 \text{ lb}}$

BLDG 3136 DDC (FROM PAGE D-34)

ELECTRIC - HVAC 75724 kWh
ELECTRIC - NON HVAC 256487 kWh
$\boxed{332211 \text{ kWh}}$

DISTRICT STEAM $\boxed{228,000 \text{ lb}}$

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CALCULATIONS FOR TOTAL ANNUAL ENERGY CONSUMPTION TABLE 4 SECTION F

BLDG 200 BASE & FMR

ELECTRIC (FROM PAGE K-4)	727,922 kWh x 3.413 kBTU/kwh =	2484398 kBTU
NATURAL GAS (FROM PAGE K-4)	29,904 Therm x 100 kBTU/Therm =	2990400 kBTU
		$\boxed{5474798 \text{ kBTU}}$

BLDG 200 PLC

ELECTRIC (FROM PAGE K-4)	666966 kwh x 3.413 kBTU/kwh =	2276355 kBTU
NATURAL GAS (FROM PAGE K-4)	22,171 Therm x 100 kBTU/therm =	2217100 kBTU
		$\boxed{4493455 \text{ kBTU}}$

BLDG 200 DDC

ELECTRIC (FROM PAGE K-4)	628,377 kwh x 3.413 kBTU/kwh =	2144651 kBTU
NATURAL GAS (FROM PAGE K-4)	18,411 Therm x 100 kBTU/kwh =	1841100 kBTU
		$\boxed{3985751 \text{ kBTU}}$

BLDG 219 BASE & FMR

ELECTRIC (FROM PAGE K-5)	903,608 kwh x 3.413 kBTU/kwh =	3083,111 kBTU
NATURAL GAS (FROM PAGE K-5)	25,043 kWh x 100 kBTU/Therm =	2,504,300 kBTU
		$\boxed{5,587,411 \text{ KBTU}}$

BLDG 219 PLC

ELECTRIC (FROM PAGE K-5)	696,551 kWh x 3.413 kBTU/kWh =	2377329 kBTU
NATURAL GAS (FROM PAGE K-5)	16,265 Therm x 100 kBTU/Therm =	1,626,500 kBTU
		$\boxed{4,003,829 \text{ kBTU}}$

BLDG 219 DDC

ELECTRIC (FROM PAGE K-5)	677,647 kwh x 3.413 kBTU/kwh	2312809 kBTU
NATURAL GAS (FROM PAGE K-5)	15,490 Therm x 100 kBTU/therm	1,549,000 kBTU
		$\boxed{3,861,809 \text{ kBTU}}$

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CALCULATIONS FOR TOTAL ANNUAL ENERGY CONSUMPTION (TABLE 4 SECTION I)

BLDG 247 BASE & FMR

ELECTRIC (FROM PAGE K-6)	2045422 kWh x 3.413 KBTU/kWh =	6981025 KBTU
NATURAL GAS (FROM PAGE K-6)	40,071 Therm x 100 KBTU/Therm =	4007100 KBTU
		$\boxed{10,988,125 \text{ KBTU}}$

BLDG 247 PLC

ELECTRIC (FROM PAGE K-6)	1,850,207 kWh x 3.413 KBTU/kWh =	6,314,757 KBTU
NATURAL GAS (FROM PAGE K-6)	28,361 Therm x 100 KBTU/Therm =	2836,100 KBTU
		$\boxed{9,150,857 \text{ KBTU}}$

BLDG 247 DDC

ELECTRIC (FROM PAGE K-6)	1,827,236 kWh x 3.413 KBTU/kWh =	6,236,357 KBTU
NATURAL GAS (FROM PAGE K-6)	27,079 Therm x 100 KBTU/Therm =	2,707,900 KBTU
		$\boxed{8,944,257 \text{ KBTU}}$

BLDG 1425 BASE & FMR

ELECTRIC (FROM PAGE K-7)	265769 kWh x 3.413 KBTU/kWh =	907,070 KBTU
DISTRICT STEAM (FROM PAGE K-7)	254,100 lb x 1.340 KBTU/lb =	340,494 KBTU
		$\boxed{1,247,564 \text{ KBTU}}$

BLDG 1425 PLC

ELECTRIC (FROM PAGE K-7)	249,395 kWh x 3.413 KBTU/kWh =	851,185 KBTU
DISTRICT STEAM (FROM PAGE K-7)	73,500 lb x 1.340 KBTU/lb =	98,490 KBTU
		$\boxed{949,675 \text{ KBTU}}$

BLDG 1425 DDC

ELECTRIC (FROM PAGE K-7)	246,561 kWh x 3.413 KBTU/kWh =	841,513 KBTU
DISTRICT STEAM (FROM PAGE K-7)	70,000 lb x 1.340 KBTU/lb =	93800 KBTU
		$\boxed{935,313 \text{ KBTU}}$